RUBBER and PLASTICS WEEKLY

VOLUME 141 NO. 21 NOVEMBER 18 1961 ONE SHILLING

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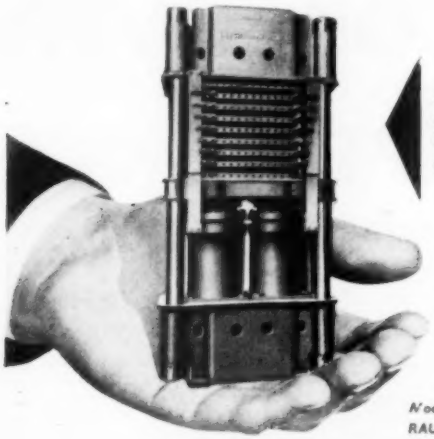
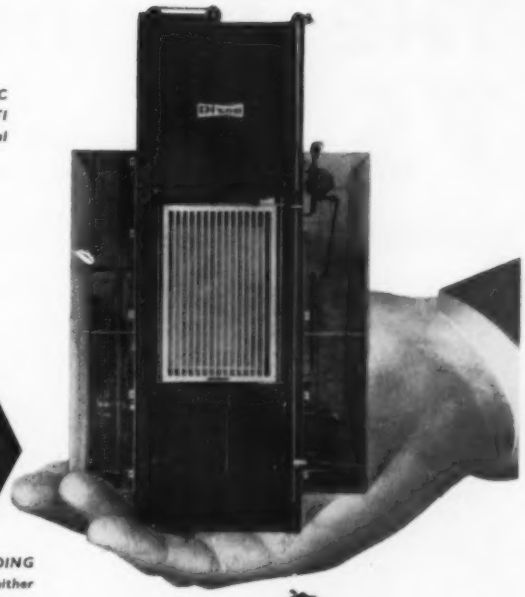


Model 810. DIXON HYDRAULIC MOULDING PRESS, MULTI DAYLIGHT. Steam-heated, total pressure 500 tons.



Model 112. DIXON HYDRAULIC MOULDING PRESS, SINGLE or MULTI DAYLIGHT. Electrically or steam heated, total pressure 176 tons.

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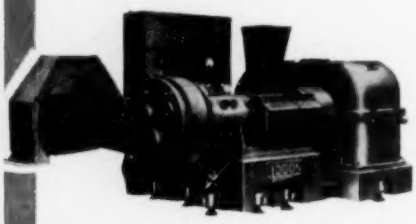
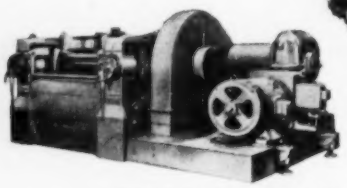
THE PRODUCT OF OVER 75 YEARS EXPERIENCE

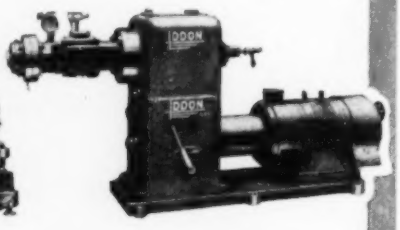
The machines illustrated will convey some idea of the variety of our productions. While IDDON standard machines cover a very wide field, it is our province to prepare special designs and adaptations to meet individual requirements, and our Consultation Service is always available.



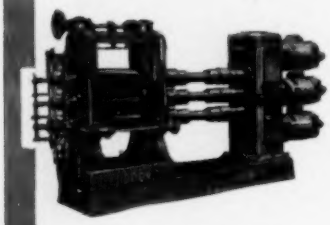
C.A.9. Strainers up to 12" dia.



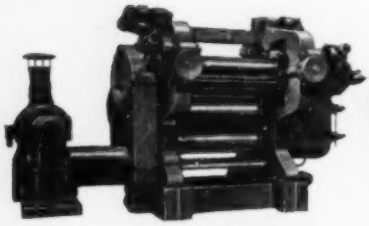
BY.11. All standard sizes of plastic and rubber mills.



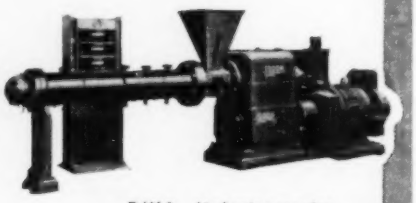
B.W.4. Rubber extruders.



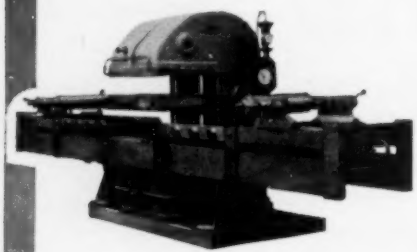
B.U.2. Laboratory calenders.



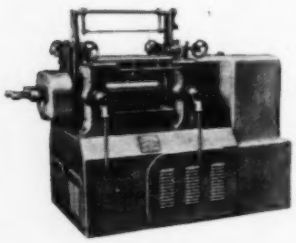
B.U.3. Precision built calenders. Details on request.



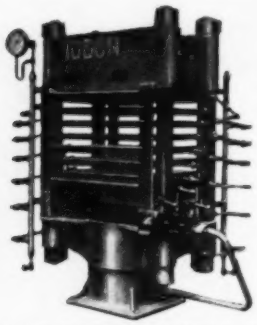
B.W.3. 6" plastic extruder.



C.D.11. Vee belt presses.



B.O.10. Laboratory mills.



B.N.9. 'Strain rod and slab sided presses all sizes — self-contained units

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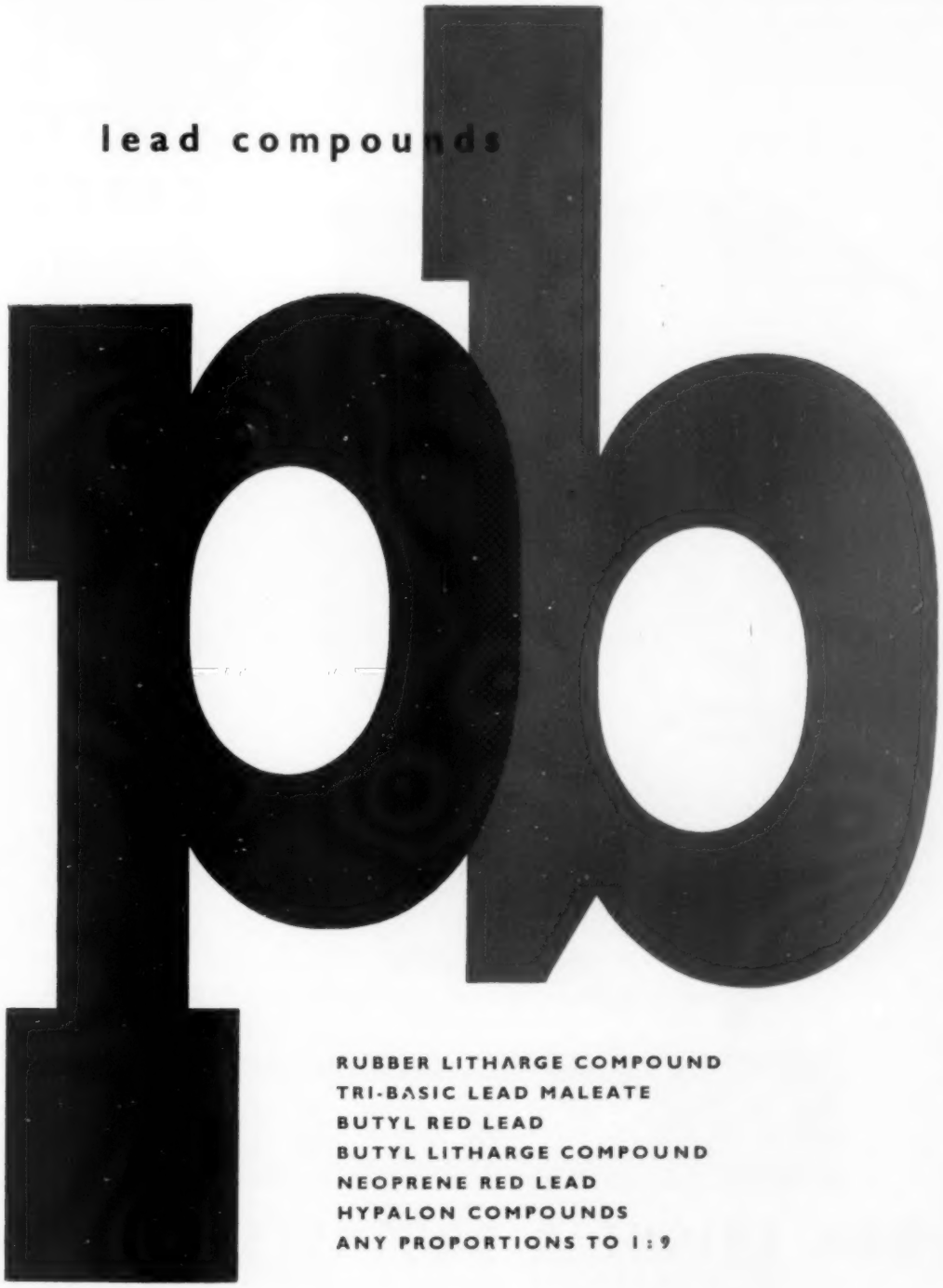

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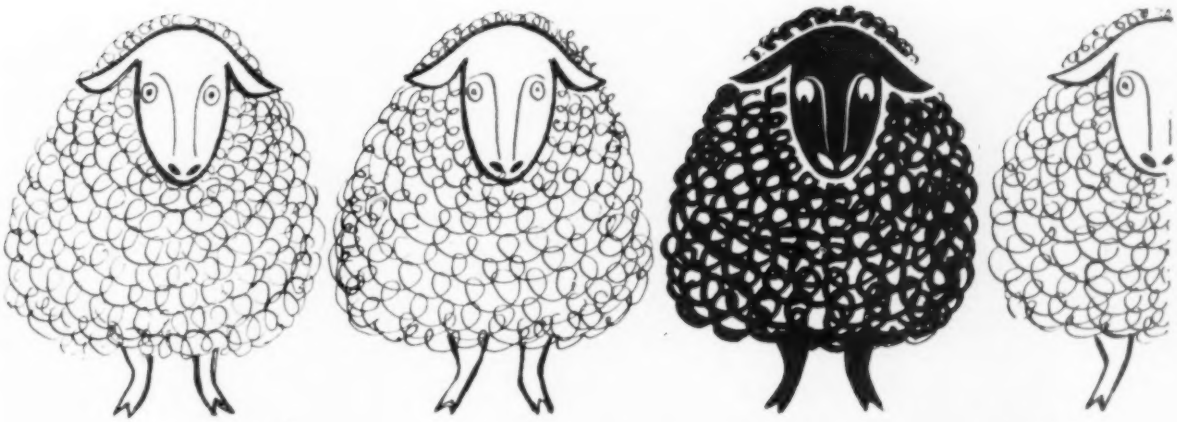

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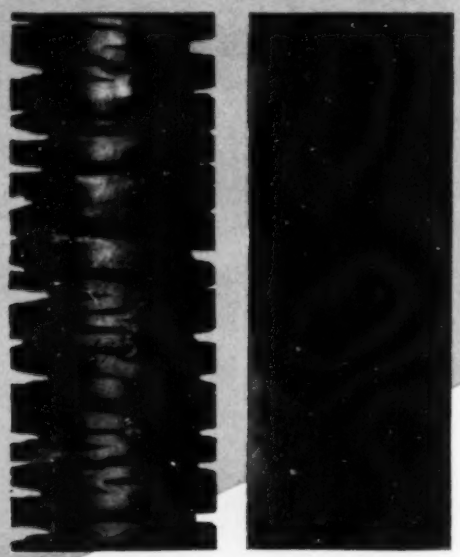
how to increase the useful life of rubber...

Effect of Curing System on Antiozonant Retention in SBR Stocks after Vulcanization

(All contain 3.0 phr UOP 88; 40.0 phr HAF black)

Compound	Accelerator	Sulfur, phr	% Extractable Antiozonant
1082....	2.0 phr benzothiazyl disulfide	2.0	66.4
1083....	1.0 phr benzothiazyl disulfide	2.0	79.6
1087....	None	2.0	~100.0
1088....	1.0 phr benzothiazyl disulfide	3.0	74.6
1063....	1.0 phr benzothiazyl disulfide	2.0	79.6
1089....	1.0 phr benzothiazyl disulfide	1.0	88.6
1053....	1.0 phr benzothiazyl disulfide	2.0	79.6
1084....	1.0 phr N-cyclohexyl-2-benzothiazole sulfenamide	—	—
1093....	1.0 phr diphenylguanidine	2.0	~18.0
1085....	2.0 phr tetramethylthiuram disulfide	—	35.0
1090....	4.0 phr tetramethylthiuram disulfide	—	12.9

The SBR specimens below were exposed to ozone at 100°F with 20 percent elongation for 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.



Carbon black—HAF (high abrasion furnace), Curing system—4 phr tetramethylthiuram disulfide; Hours to first crack—7 to 23.

Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 1 phr N-cyclohexyl-2-benzothiazole sulfenamide. No cracks in 239 hr.

Represented in United Kingdom by: UNIVERSAL-MATTHEY PRODUCTS LIMITED, Stockingswater Lane, Brimsdown, Enfield, Middlesex

CONSIDER THE EFFECT OF YOUR CURING SYSTEM ON THE EFFECTIVENESS OF A CHEMICAL ANTIOZONANT

In compounding rubber, there are several things which are important in assuring maximum crack-free life. First, you must use a potent antiozonant like UOP 88 or 288. Next, consider what a vast difference in effectiveness can be realized by your *curing system*.

The right antiozonant used in correct proportion is of primary importance. Then, by using the proper accelerator, you can promote its maximum effectiveness, and thus contribute to maximum ozone protection.

Look at the two rubber test strips illustrated. Both were formulated with UOP 88 . . . but note how much more effectively the antiozonant worked when accompanied by this change in curing systems—a vast increase in resistance to cracking. The table above the test strips shows how the *proper* accelerator aids antiozonant effectiveness.

Help in achieving maximum effectiveness from UOP 88 or 288 antiozonants in your rubber formulations is available through UOP facilities and technical personnel. Just write or telephone our Products Department.

WHERE RESEARCH IS PLANNED WITH PROGRESS IN MIND

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Des Plaines, Illinois, U. S. A.

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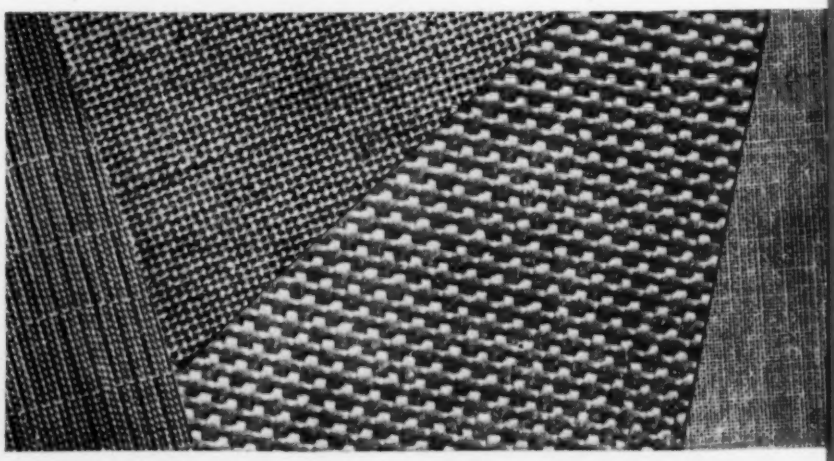

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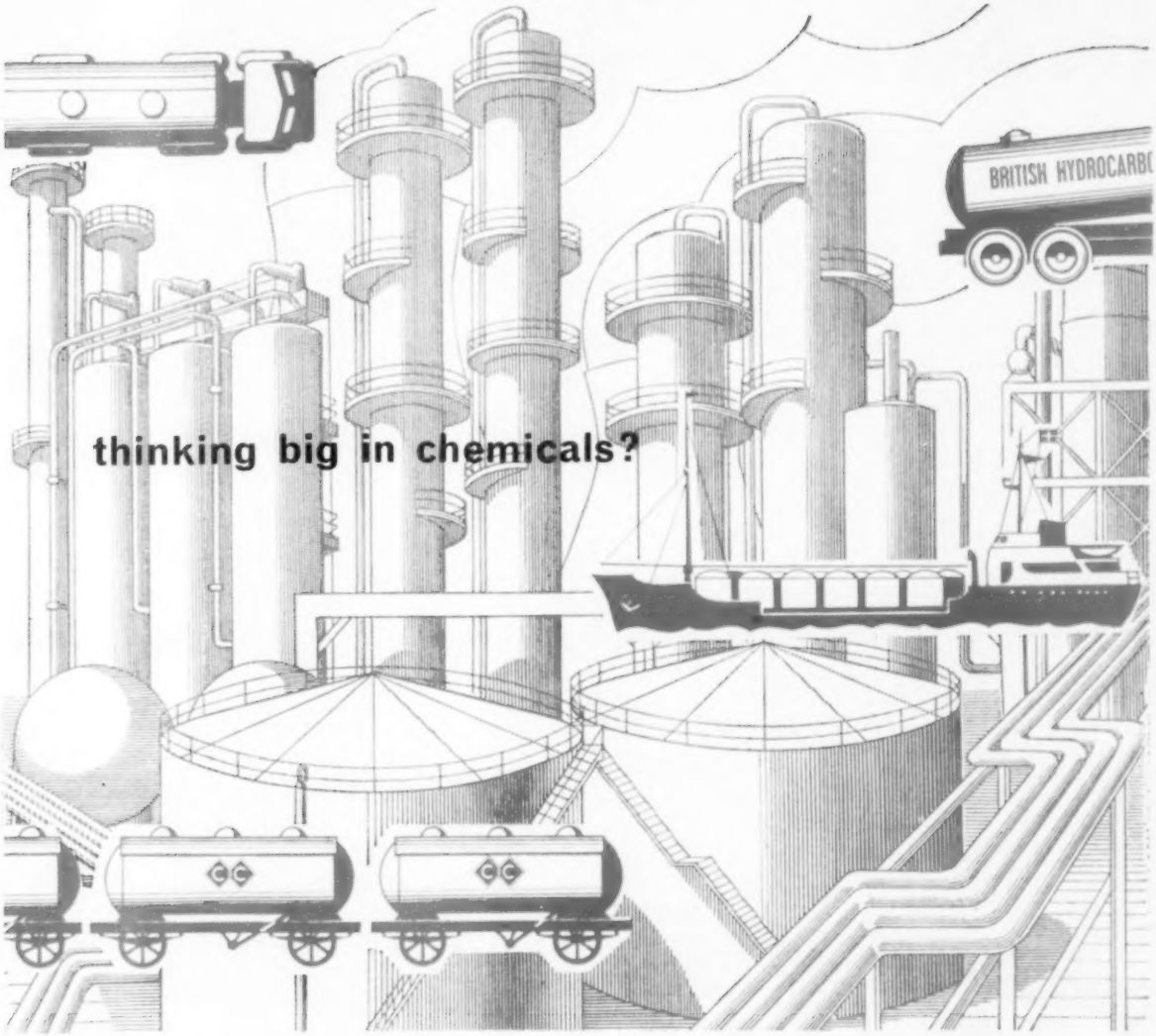

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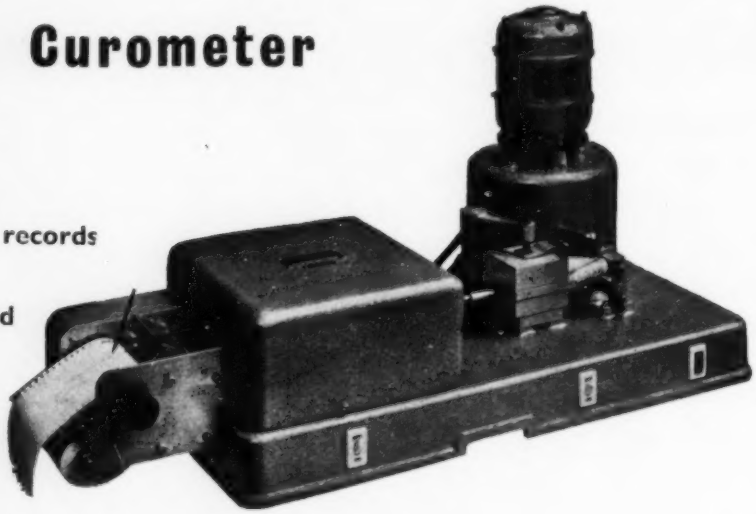

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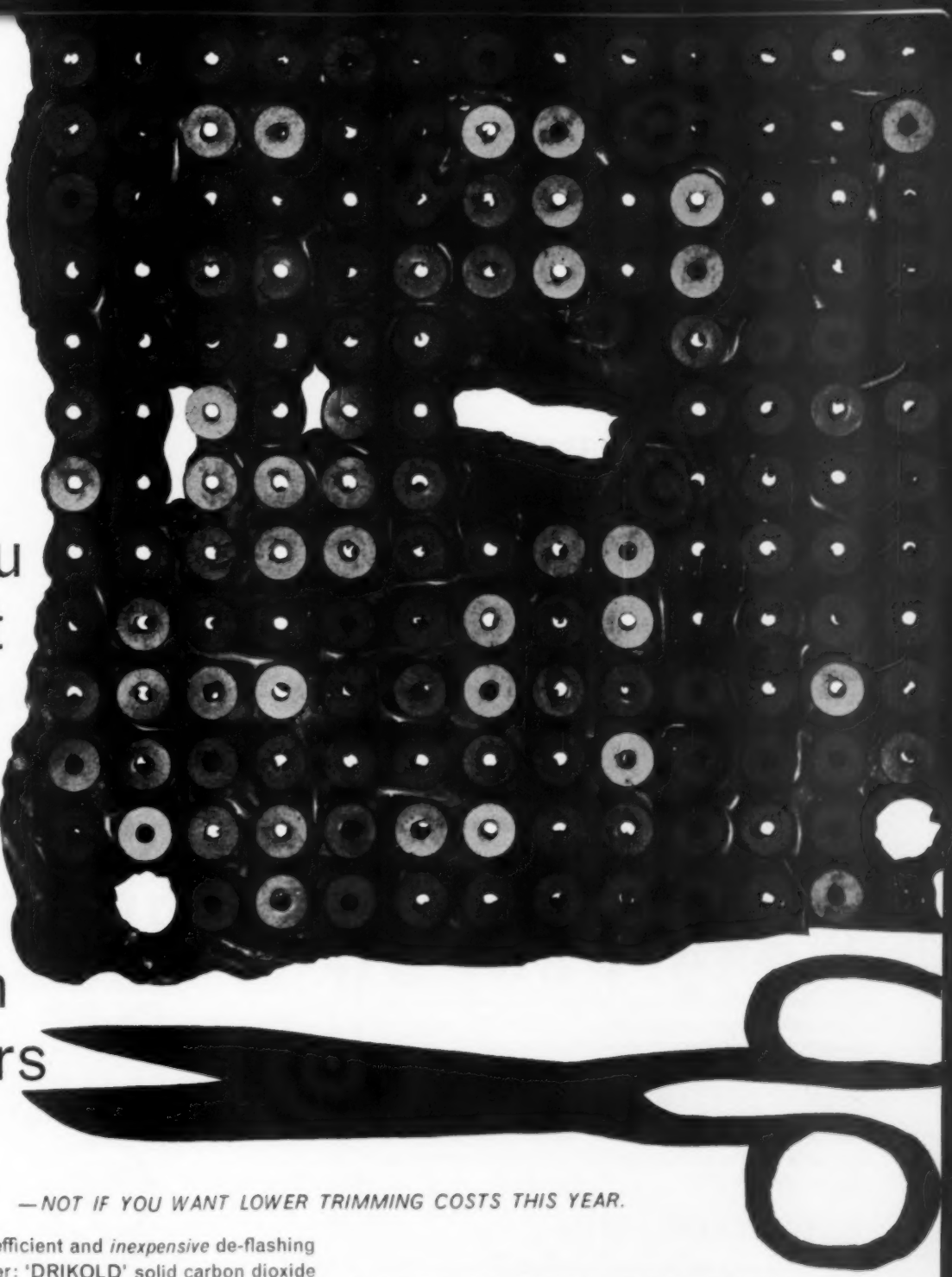

you can't run round this lot with scissors

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Please send me your literature on de-flashing with 'Drikold' ☐
I should like further information about the Columbian International sub-zero tumbler ☐

Tick as required

NAME.....

ORGANIZATION.....

ADDRESS.....

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DE342

The uses of Mica powder in rubber manufacture

LATEX FOAM

Mica powder shows advantages over other extenders. It increases compression hardness without undue reduction of other physical properties. The cost of latex foamed products can be reduced by offsetting this increase in hardness, by foaming the latex to a larger volume. Mica powders also facilitate mould release.

LATEX COMPOUNDS

Mica powder produces a marked hardening of latex film, making it particularly suitable for hard casting compounds, adhesives and latex flooring compounds. Mica is also excellent for preventing undue penetration of latex spreading compounds when applied to fabric and other porous bases.

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Mica powder is ideal with its chemical inertness and plate-like structure, it is equally effective applied either dry or wet, in the form of a slurry water or soap solutions.

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micafine

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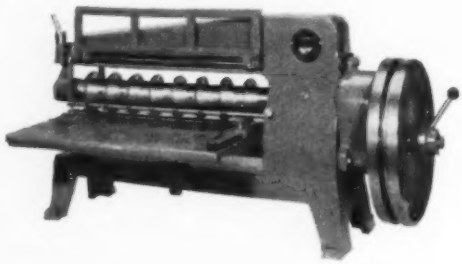

If you have a cutting problem consult:

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RUBBER and PLASTICS WEEKLY

Formerly 'Rubber Journal and International Plastics'

Volume 141 IN ITS 78th YEAR No. 21

November 18 1961

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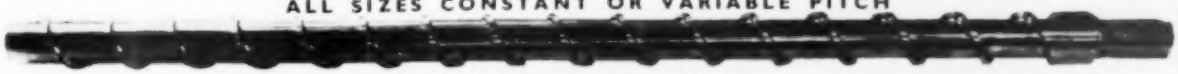

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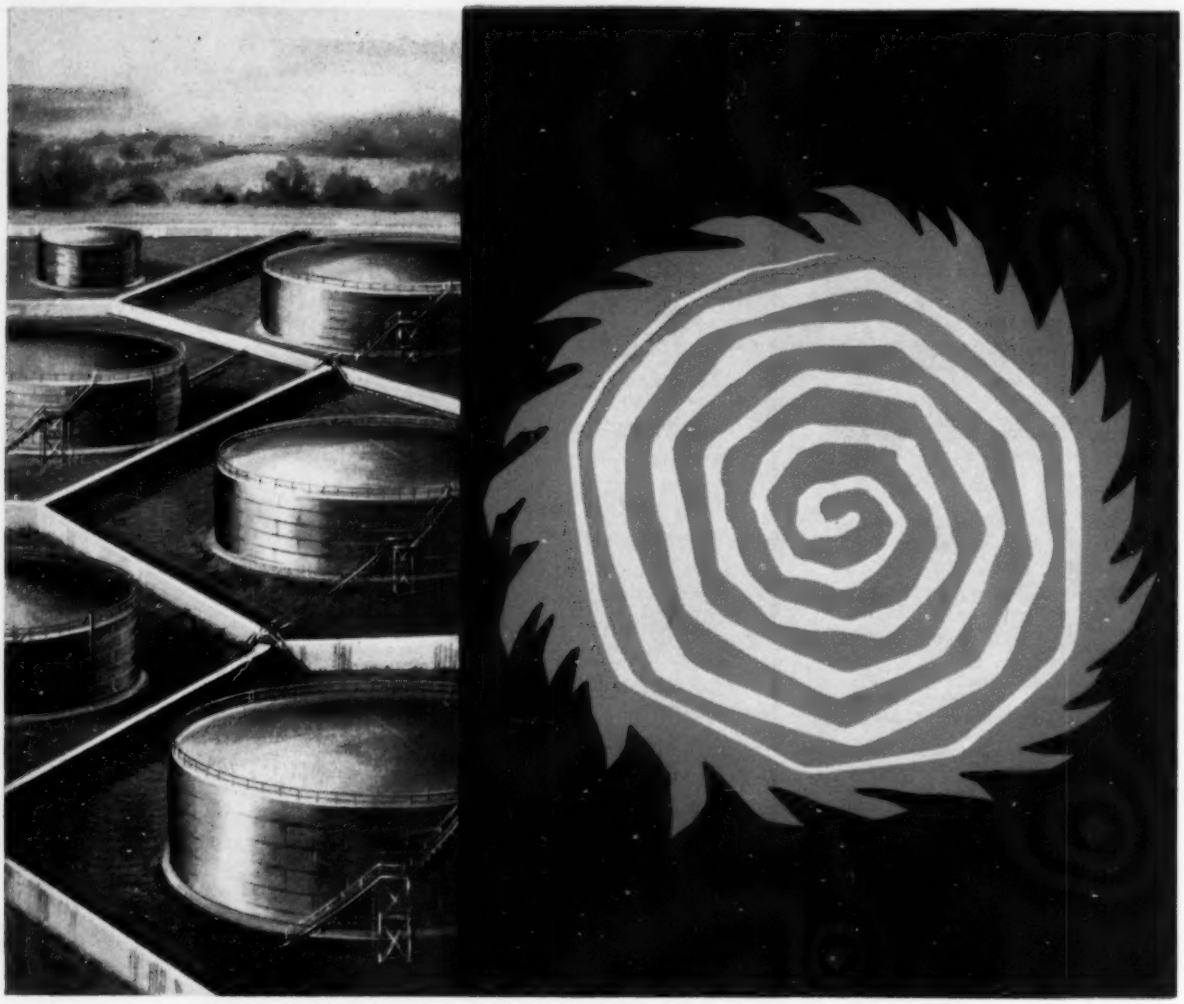

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NOTES of the WEEK

The Significant Sixties

EVEN at this early stage it looks as though the sixties will be regarded as a highly significant decade in the elastomeric field. So far we have seen the commercial development of polybutadiene and polyisoprene and have scarcely had time to catch our breaths before the commercial manufacture of ethylene propylene copolymer has begun in USA. As previously reported (*RPW*, September 23, 466) Enjay Chemical Co., a division of Humble Oil and Refining Co., is now selling tonnage quantities from commercial facilities at Baton Rouge, Louisiana. The development price is 26d. a lb. and latest reports suggest that manufacturers are not being slow in taking up its evaluation.

As the rubber becomes commercially established the price should drop sharply — quite apart from the quantity drop, both monomers are very cheap. The synthetic is attracting interest in the electrical industry; combined with its electrical properties it has good ozone, ageing and chemical resistance — it is a completely saturated copolymer. (The lack of double bonds means, of course, that it cannot be vulcanized in the normal manner and Enjay is recommending a peroxide cure.)

According to the American *Rubber World*, which has published one of the first assessments of ethylene propylene since its commercial introduction, several other producers in USA may be 'close to commercial production'. It reports that a small evaluation plant completed recently by the Naugatuck Chemical Division of United States Rubber Co. has a capacity of 1,500 to 2,000 tons of polybutadiene and ethylene-propylene. Hercules Powder Co. and Avisun Corp. are also said to be involved, while Du Pont may have small quantities of a sulphur vulcanizable polymer available by the end of the year. This is being done, apparently, by incorporating non-conjugated dienes to a small extent so that cross-linking can be achieved without affecting the main chain.

Standing Example

NOT only is the new plastics laboratory* at Shell Chemical Co.'s Carrington complex a fine addition to the company's technical service and development facilities, it is a standing — in fact, an outstanding—example of the confidence the company has in its materials. A good part of the laboratory is built with the materials it services and develops. PVC/steel and pvc/asbestos exterior panels, polypropylene sinks, high-impact pvc gutters, low-density polythene waste pipes and fittings, and high-density polythene cisterns — these are just a few examples of plastics applications in the new laboratory. The materials have been chosen carefully, with a regard for their properties and the conditions they will have to face.

A point made in a report on the selection and installation of the plastics products is that a new approach was demanded for fixing and protection. Without special instructions — and no doubt, in some cases, in spite of them — workmen often tried to fix plastics materials in a 'traditional manner'. For instance, the report says that the installation of polythene cisterns was satisfactory, but workmen tended to treat the polypropylene sinks as though they were the standard fireclay article and these had to be replaced.

Two points emerge from this. *Seeing* the successful use of plastics in building on a scale like this could be more convincing to architects and builders than a million brochures. This year Chemische Werke Hüls has ferried a great number of architects and builders through its plastics in building exhibition (and its plastics house) at Marl, West Germany. At the moment I.C.I. is touring the country with the 'plastics in building' exhibition with which it scored such a great success at Interplas. This is thinking on the right lines, but by erecting a more permanent showplace manufacturers — or the industry as a whole — could do themselves a power of good in a market which holds boundless opportunities for plastics.

The second point is that education in plastics should not stop at the architect and builder, but should go right on to the building site. The British workman handles glass with care but to him a polypropylene sink is 'just another bit of plastic'.

Taken Seriously

THE Chief Inspector of Factories recent report stressed that last year was a bad one for industrial safety. That this has been taken very seriously by the rubber industry is shown by the structure of a Safety Study Conference held this week at Southport by the Rubber Manufacturing Employers' Association. The fact that the nucleus of a firm's attitude towards safety is found in the boardroom was brought out by Bernard Inshaw, head of the industrial safety division of RoSPA. The third biggest culprit in accidents in the rubber industry is falling materials — 216 out of 2,285 accidents in 1960. This subject was brought under close scrutiny at the conference, as were two other safety topics that have been very prominent in the minds of industrialists recently — fire protection and publicity. A report on this important conference will be given in next week's *RPW*.

*An article on the Carrington Plastics Laboratory appears on page 832.

NEWS *Briefs*

GOODYEAR SA FACTORY SABOTAGED? — DUNLOP BULAWAYO STRIKE—CONTINENTAL TYRE PLANT ZAGREB PLASTICS FAIR — JAPAN ACETAL MOVE

●**Rhodesia** — Production at the Dunlop factory at Bulawayo came to a halt on November 13 after 250 African workers stopped work because they wanted more pay. The works director, K. J. Hicking, warned them they would be discharged if they were not at work by 8 a.m. The gates were locked at that time and Mr Hicking said: 'So far they have refused to negotiate but if they change their minds we will be ready to talk'.

●**United States** — The Goodyear Tyre and Rubber Co. has reduced the truck tyre dealer prices by up to 23.2% to bring them more in line with heavily discounted selling prices. The changes, effective since November 1, cover all sizes of truck and some sizes of off-the-road tyres, but do not affect passenger car tyres or farm tyre prices. Other leading tyre producers are expected to follow the price cut which is an effort to stabilize industry pricing of truck tyres, a very competitive sector of the industry.

●**Argentina** — Police are investigating the possibility of sabotage at the Goodyear Co.'s factory outside Buenos Aires, where fire recently destroyed valuable stores of natural and synthetic rubber. Quick action by the Fire Brigade and Air Force prevented flames spreading to the actual factory. The fire came on the first day of a three-day country-wide general strike called by the General Confederation of Labour.

●**West Germany** — Continental-Gummi-Werke AG, one of West Germany's leading tyre producers, has confirmed that it is to build a subsidiary factory at Sarreguemines, Lorraine, Eastern France. The new subsidiary plant, named Continental-Reifenfabrik Saargemuend, is due to be completed by the end of next year, and should start tyre production early in 1963.

●**Canada** — The Dominion Rubber Co. may produce foambacks at its Kitchener plant. This possibility was stated by the president, M. F. Anderson, at a dinner in Montreal. He said that he expected 1961 sales to top last year's record high.

●**France** — Two State - controlled French banks, Comptoir National d'Escompte de Paris and Credit Lyonnaise are to finance a NF61.5m. engineering contract for building a synthetic rubber plant in Brazil. The credits will be granted to Companhia Pernambucana de Borracha Syntetica (Coperbo) and cover engineering and equipment supplies. The rubber plant will be set up at Cabo, in the State of Pernambuco.

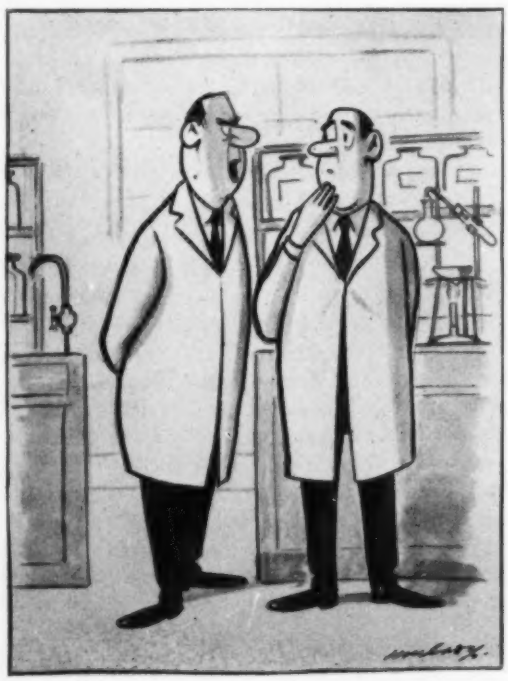
●**Argentina** — The Ministry of Economy has authorized the foreign capital investment of US$1.8m. by Hooker Chemical Corp. of the USA, through Duranor Industrias Quimicas, in cash and technical information, and a US$2m. loan from the US Export-Import Bank in machinery, for a plant to produce phenol.

●**France** — Manufacture Française de Pneumatics Michelin is to raise a NF120m. loan by the issue of 600,000 debentures each of NF200 at 5% for 20 years.

●**Yugoslavia** — A specialized International Plastics Fair will be included in the Zagreb Spring Fair (April 13-22 1962). Firms that are said to be interested in taking part include: I.C.I., R. H. Windsor Ltd., Montecatini, Reifenhauser, and the Celanese Corporation of America. Yugoslav production of plastics raw materials is expected to reach 60,000 tons by 1965.

●**Japan** — Nippon Shokubai of Osaka, recently applied for patents on the manufacture of polyformaidehyde resins which, claims the firm, do not infringe patents registered by E. I. du Pont de Nemours for its Delrin polyacetal resins. Nippon Shokubai is said to have recently developed its own production techniques for polyformaldehyde resins and, according to reports, the intermediate plant has been under construction for some time.

●**Malaya** — The Prime Minister of Malaya, Tunku Abdul Rahman, has urged the leading contributing countries in the Colombo Plan to work 'speedily and constructively' to eliminate trade barriers against the goods of primary producing countries. He was opening the Ministerial conference of the 21 Colombo countries at Kuala Lumpur. He said: 'There is plenty of evidence that fluctuations in the prices of primary commodities can bring adverse consequences for the industrialized countries. Therefore it is in the interest of all of us to tackle this problem fairly and effectively'. He urged Colombo Plan members to 'exert their full influence' in support of the present UN investigation into ways and means of providing cash compensation for primary producing countries hit by fluctuations in their income from exports.



'Why don't you cut out this "Eureka" stuff — the only thing you've discovered is a dirty little pile of ash' — *563*

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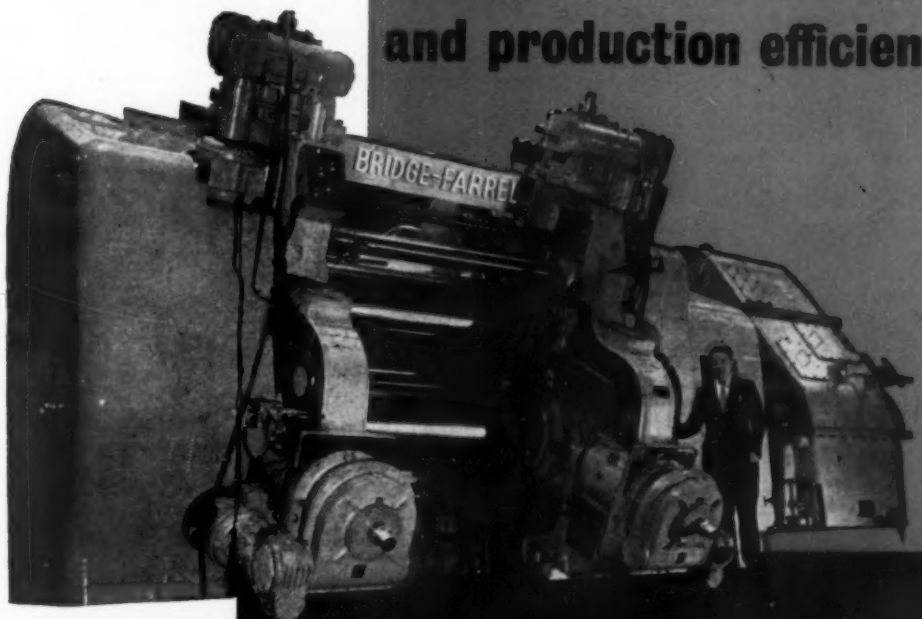

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'Six' SBR Producers Worried

LACK OF PROTECTION AGAINST AMERICAN EXPORTS

COMMON Market synthetic rubber producers are worried about their lack of protection against exports from America and Eastern Europe, according to a report from Paris on Tuesday (November 14).

A spokesman for the major French producer Société de Elastomers de Synthese, expressed concern about the synthetic exports.

He said that Common Market rules put synthetic rubber on 'list G' without any Customs protection, while the USA, Canada and Britain remained 'well protected' against foreign competition.

This meant, he declared, that excess American output could be shipped to Europe. American producers had a price advantage, because, although production costs were similar in both countries, redemption charges on the older American synthetic plants were lower.

Common Market countries had no means of stopping such sales, the spokesman said, and there was no provision for joint anti-dumping procedure.

The First Target

The Six were also likely to be the first target for East German and Polish synthetic rubber products. The industry in these countries was being built on such an ambitious scale that an initial production surplus was inevitable.

'The West European market is the easiest outlet for such surpluses', the spokesman said.

Société des Elastomeres, owned by the Shell Group and Texas Butadiene and Chemical Corporation of Houston, with some participation from French tyre makers, recently opened a styrene-butadiene rubber plant at Berre, near Marseilles.

Its capacity is from 50,000 to 70,000 tons a year, depending on the type of production, which will be sold on the domestic market only.

The company plans to extend the NF100m. plant through construction of a polybutadiene rubber unit, due to start production in 1963.

And in New York:

Also on Tuesday there was activity in the synthetic rubber field in New York.

Shell Chemical Co. made a snap announcement that, effective from November 15, the price of its *cis*-polyisoprene would be notched down to 23 cents a lb. fob Torrance, California.

Previous price was 25cents a lb.

Whereas the economic policy of the other synthetics has been to keep a stable price, there has been a tendency for Shell to move the price of polyisoprene with the price of natural.

In part, for example, this latest reduction could be connected with the recent stockpile releases which have cut the market price of natural.

£330,000 Cable Contract

Against severe international competition the British Insulated Callender's Cables Group has secured a £330,000 contract from the Central Electricity Board of the Federation of Malaya for the supply and installation of some 60 miles of cables for the Cameron Highlands hydro-electric scheme. This is one of the largest contracts of its kind ever to be awarded by the CEB of Malaya.

The cables will include some three miles of 132kV. power cable installed in an inclined shaft to the underground power station, 25½ miles of 11kV. power cable and four miles of 660/1100 volt paper-lead and pvc insulated power cables.

Advice for I.C.I.'s European Council

Dr J. Kymmell, Director of European Integration in the Dutch Ministry of Foreign Affairs, has been appointed Economic Advisor to I.C.I.'s European Council. This is the organization set up by I.C.I. earlier this year to supervise its interests in Europe as a whole.

In February this year I.C.I. announced plans to build a complex of chemical plants for the manufacture of petrochemicals and related products, at Rozenburg, near Rotterdam. Later it was announced that the first project would be in the field of plastics, and the expenditure of £7m. had been approved for the erection of plants.

Cariflex Isoprene Price Cut

Shortly after Shell in USA had announced a polyisoprene price cut (*see column 2, this page*) Shell Chemical Co. in the UK said it was reducing the price of its Cariflex polyisoprene by 2d. a lb.

As from Thursday (November 16) the new prices have been (ex store): I/300 and I/305 24.5d. a lb. and I/500 (oil extended polymer) 21.5d. a lb.

DTD Approval for RTV Silicone Rubbers

COLD-CURE Silastomer, the Midland Silicones' range of room temperature vulcanizing rubbers has been given full DTD 900 approval by the Ministry of Aviation to cover the encapsulation and sealing of electrical and electronic components, and the fabrication of silicone rubber components where the requirements of DTD 818 are not applicable.

The rubber is available in varying consistencies from thin fluids to heavy, putty-like materials. By varying the amount of catalyst it is possible, within limits, to predetermine the curing time from about ten minutes to more than four hours. Like heat-cured Silastomer, the cold-curing type withstands continuous exposure to extremes of temperature with little change in physical or dielectric properties.

The DTD approval references are: cold cure Silastomer 9159 — DTD 900/4692; 9160 — DTD 900/4693; and 9161 — DTD 900/4694.

Catalyst N 9162 is included in these approvals. Approval for Silastomer 9160 (medium grade) also extends to the manufacture of pressure-tight transparency seals.

Stockpile Releases: Thailand Reacts

The sales of rubber from the US rubber stockpile would adversely affect rubber prices and the export earnings of Thailand to a great extent, Finance Minister Sunthorn Hongladarom said at a press conference in Bangkok.

He added that the US Government might have its justified reasons for selling rubber from its stockpile. But 'every effort should be taken by the big countries to help maintain at reasonable levels the prices of primary commodities on which countries like Malaya, Thailand and Indonesia depend so much'.

Under USA's temporary revision of the selling structure of its stockpile rubber, rubber can be sold below 32 cents a lb. up to a maximum of 5,000 tons a month. This followed a similar move by the UK.

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SEVERAL UK UNIVERSITIES CONDUCTING RESEARCH

RESEARCH on the use of sugar in developing low cost plastics and other chemicals is under way at several institutions in the UK. Grants for these studies are being provided by Sugar Research Foundation, Inc., which is supported by the sugar industry in the UK, Canada, and other countries. Information released this week by the Research Foundation gave some details of the work planned in the UK.

At the University of Bristol, Dr Leslie Hough is engaged in research of improved methods of producing sucrose carbonate polymers — sugar-based compounds useful in the field of plastics.

At Royal Holloway College, Surrey, Professor E. J. Bourne is carrying out research on certain derivatives of sugar which may yield plastics.

Resins for Surface Coatings

It is said that the Webber-Yarsley Research Laboratories Ltd., in Chessington, will conduct two projects. One investigation will be concerned with the use of sugar in developing resins used for surface coatings, insulators and moulded articles.

The other project will involve the chemical reaction of sugar with heavy metal oxide compounds which, it is hoped, will yield useful cements and adhesives.

All told 25 research projects will be supported in member countries by the Sugar Research Foundation Inc., during 1962.

Since 1943 more than $3.5m. has been spent by the sugar industry through the foundation to help discover and develop new and significant uses of sugar and its by-products.

Lintafoam in Dundee

Lintafoam Industries Ltd. is to construct a new 65,000 sq. ft. factory at an industrial estate in Dundee.

Rubber-coated textile materials will be produced; much of the additional capacity will meet the increasing demand for rubber-backed carpeting and carpet underlays.

Recently Lintafoam acquired the capital of Marshall and Brush, the Dundee carpet manufacturers.

Light for Fires

A new fire hose — incorporating a woven all-nylon jacket to which is fused a lining of pvc compound — has been developed by BTR Industries Ltd. Called Plastiweave, it is an addition to BTR's established range of hose specially-designed for fire-fighting purposes.

Plastiweave is an extremely lightweight hose, and meets JCDD specification for a nominal burst pressure of 500psi.

New Filon Features

BIP Reinforced Products Ltd. recently introduced its new range of Filon polyester glass sheeting.

New features are: 1. Weight. Two new 6oz. sheets replace the previous 8oz. and 6oz. sheets. The incorporation of 2oz. of glass fibre to every 4oz. of resin (previously 1½oz. to 4½oz. in the 6oz. weight) results in increased strength. 2. A new improved range of opaque and semi-opaque colours replaces the previous colour range.

Heat Sealing Teflon FEP Film Development

THE development of an improved type of cementable Teflon FEP-fluorocarbon film that can be heat-sealed has been announced by the film department of Du Pont de Nemours International SA.

Other improvements of the new cementable FEP-film are claimed to include better tensile strength and elongation, particularly for the thinner gauges, resistance to discoloration at high temperatures, and expanded outdoor life.

Du Pont says that these improvements are the result of technical advances in the manufacturing process which have made it possible to eliminate the thin coating of epoxy resin which was previously used to protect the specially treated cementable surface on one side of the film. This surface permits the film to adhere to a variety of substrates with a large number of commercial adhesives.

The protective coating of resin previously used did not permit the cementable surface of the FEP-film to be heat-sealed. It also caused some discoloration at high temperatures due to degradation of the resin.

A further disadvantage of the resin coating was that it was sensitive to ultra-violet rays.

Applications

End-use applications of the film, using epoxy resins as bonding agents, include liners for glass-filament-wound chemical and cryogenic fuel tanks and cylinders, 'anti-stick' ice-release coatings on aluminium trays, and release cladding on heated or chilled processing rolls.

Using rubber adhesives, the film can be cemented as liner for rubber and fabric hose and tubing, and over rubber and asbestos for chemically resistant diaphragms and seals.

Other standard adhesives can be used to apply the film to fabric and rubber conveyor belting, and to make types of pressure sensitive tape.

It can also be used without adhesives to provide a printable surface on spiral-wrapped heat-sealed jacketing for wire and cable.

FEP film is said to have very low permeability to liquids, gases, moisture and organic vapours. It is pinhole-free and it can be vacuum-formed and metallized. It is also transparent in thin gauges.

RAPRA Plastics Research

The Rubber and Plastics Research Association of Shawbury, Shrewsbury, is continuing to receive offers of assistance for its new plastics research laboratories.

Offers relating to the structure of the building have been received from:

Smiths Motor Accessories Ltd., Plysu Sales Ltd., I.C.I. (Hyde) Ltd., F. W. Berk and Co. Ltd. and Michael Nairn Ltd.

Machinery and equipment has been offered by:

J. H. Fenner and Co. Ltd., Sutcliffe Moulded Rubber Co. Ltd., Saunders Valve Co. Ltd., Electric Hose and Rubber Co. Ltd., Amalgamated Oxides (1939) Ltd., Catalin Ltd., Johnson and Johnson Ltd., India Tyre and Rubber Co. Ltd., Whiffen and Sons Ltd., Redfern's Rubber Works Ltd., Hellerman Ltd., and Firestone Tyre and Rubber Co.

Monetary assistance has been received from:

ITS Rubber Ltd., Hubron Rubber Chemicals Ltd., and London Rubber Industries Ltd.

Firms listed above are in addition to those which have already appeared in *RPW*. Member firms interested in assisting with this venture should write to the secretary, RAPRA, Shawbury, Shrewsbury, Shropshire.

Architectural Range

Formica introduced a new architectural range for outside use on Tuesday (November 14), at a preview to the Building Exhibition.

ENGINEERING MATERIALS AND DESIGN EXHIBITION

Polymers Take a Back Seat

ONLY COATINGS AND REINFORCED PLASTICS REALLY REPRESENTATIVE

IT was surprising to find a comparative lack of rubber and plastics products at the second Engineering Materials and Design Exhibition, which opened at Earls Court on Monday and closes today (November 18).

Out of a total of 95 exhibitors, only 27 included plastics products. Of these exhibitors, only 15 of them had plastics as their principal business, the others simply referring to 'plastics'. Natural and synthetic rubbers were even less covered, although there were suggestions for the use of neoprene coatings for various purposes.

It is difficult to analyse the reasons for this apparent dearth of plastics. We have all come to believe that plastics are making great inroads into the heavy engineering field but this was certainly not indicated at the exhibition. It is suspected, however, that this may be due to a certain inertia on the part of the plastics industry due to the many exhibitions which they have to cover. There are so many industries which use plastics to a lesser or greater extent, that manufacturers just cannot appear at all of them.

Outline of Materials

It may seem surprising in many ways that glass reinforced polyesters were the most common materials on show. The products made from them were in general use for heavy engineering, and not the usual car and boat bodies that have become so well known.

The next most popular material was nylon, used so extensively for small moulded and fabricated products. In addition, much larger mouldings are now being made from the material.

The various vinyl products, and pvc in particular, were only reasonably well represented. It is surprising to report that no fabricated rigid pvc structures were on show at all. In general, pvc was represented by various coatings.

Two other reasonably popular materials were the epoxy resins (used as an alternative to polyesters in glass laminates) and ptfe. The latter is becoming increasingly popular for self-lubricated bearings.

Other common materials mentioned included polyurethanes, polystyrene, polypropylene, acrylics, phenolic resins and cellulosic products. All of these materials were very poorly represented however.

It was promising to note the intrusion of the newer materials into engineering applications. These products included polyacetals, polycarbonates and abs.

In the synthetic rubber field, silicone rubbers were the most prominent. Both I.C.I. Ltd. and Midland Silicones Ltd. exhibited their products. Nitrile latices were also mentioned for the production of dipped products and neoprene was employed for providing protective coatings on various metal components.

Plastics Coatings

The exhibition made it quite clear that the application of plastics to various surfaces, particularly metal, was very popular. It has clearly now been accepted that thin plastics films, applied by a variety of methods, provide very good protection indeed.

The field may be divided into several parts. First there are those companies which supply plastics coated metal strip for further processing; second those which supply coating services; third suppliers of coating materials; and fourth, those who coat various plastics or synthetic rubbers on to their own products.

In the first category, Coated Strip Ltd., produce mild steel and aluminium strip in continuous coils with coatings of paint, lacquer or pvc. In one process, a film of plastisol is employed to give a coat up to 0.014in. thick (which is also embossed if required) and in another process a pvc film is applied in thicknesses of .002in. to .003in. These products can be readily fabricated and typical examples include small pressed parts for batteries, rolled sections for venetian blinds and the bases of Dinky toys. In a rather different category, Simmonds Aerocessories Ltd. used plastics coated aluminium and anodized aluminium covers for concealing screw heads.

In the second category, Plastics Coatings Ltd. are, of course, very well known. They dip and spray such products as chemical stirrer paddles, salt water pumps, metal flanges and pipe fittings etc., with a wide variety of materials, including polythene, pvc, nylon, ptfce, Penton and ptfe.

In the third category, E. and F. Richardson Ltd. supply a very wide range of coatings. These are divided into two main types, elastomeric and hard. The former are based on synthetic rubbers, such as neoprene, Hypalon and Viton and the latter are based on resins such as the epoxies, phenolics and polyurethanes. Suitable primers are also supplied. Specific instances of application include for lining tanks, vats and containers,

Closed-circuit television on the British Resin Products Ltd. stand was provided by Murphy cameras—with casings moulded in Cellobond polyester glass by John Colinsons Ltd.

coating valves, pump impellers, sewer, pressure and vacuum vessels, fume ducting and the like. Coating Contractors Ltd., a subsidiary of E. and F. Richardson Ltd., apply these materials on site and at their plant. The trade name of their products is Adcora.

Again in the field of supply of materials, Polypenco Ltd. produce a range of finely divided powders for application by the fluidized bed system. These include vinyls, cellulosic, epoxy, nylon and Penton. These materials indicate the rapidity with which the fluidized bed technique is now developing.

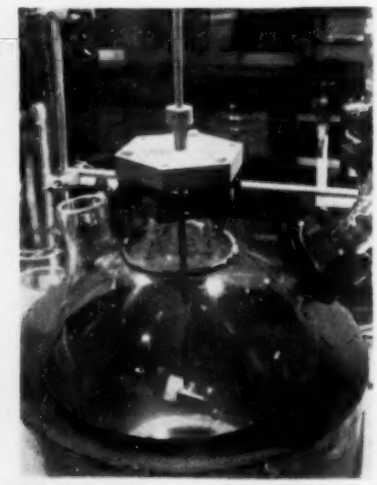
It is strange to find such a company as British Rolling Mills Ltd. entering the field of plastics. However, they are using Storeys Plastolam 860, containing wholly polymeric plasticizers, to coat steel to give Brymill. A very wide range of decorative colours and printed effects are available.

Although the products of Bound Brook Bearings Ltd. are hardly coatings, yet it is convenient to include them in this field. Their Polyslip IM dry bearings are based on the use of ptfe which is embodied into a rigid porous metal matrix.

Reinforced Plastics

Although we have become accustomed to think of glass fibre/polyester mouldings as being used primarily for covers, the exhibition showed that they can also have functional purposes. Quite a number of companies and institutions made use of the materials, including the UK Atomic Energy Authority.

British Resin Products Ltd. demonstrated their polyester resin products, particularly Rockite dough moulding compounds in the electrical industry. The exhibits ranged in size from heavy duty switchgear with Rockite DMC insulators to a soldering iron with a Rockite DMC handle. Also on show were a fan with a sisal filled DMC outer casing and a lightning arrestor with a DMC cap. This piece of protective apparatus has been designed to withstand extremes of climate. An interesting novelty on the stand was the use of closed circuit television by the use of three Murphy cameras to illustrate the use of Cellobond polyester/glass casings.



Stirrings rods and chemical flask seals by one exhibitor — Tufnol Ltd. — are corrosion resistant and have a slight resilience which makes them 'kind' to expensive chemical containers

Harvey Sales (M/cr.) Ltd. exhibited a number of heavy engineering products fabricated from reinforced plastics. These included an experimental motor fan shield 30in. in diameter; a platform type appearance cover on a turbo generator and a louvred end shield. Another one of their products was their Harviglas rods and bars made from unidirectional filament for subsequent machining.

Fibreglass Ltd. exhibited a number of products to illustrate the use of their glass products in combination with polyester and epoxy resins. Typical examples included a filament wound 315 gallon tank for Whessoe Ltd.; a pvc pipe armoured with FRP; machined mouldings of ptfe reinforced with Fibreglass; a Permutit water softener having a GRP case and so on.

One of the products referred to above was the use of materials reinforced with Fibreglass. A very good example of this was exhibited by Tuff Plastics Ltd. who are using their Tufplas to manufacture industrial ducting, tanks, cyclone units and the like. This material is a rigid impact resistant pvc with a reinforcement of glass fibre laminate. It is claimed that this results in an increase of overall strength to ten times that of the plain pvc.

A comparative newcomer to the polyester field is United Coke and Chemicals Ltd. Their Orkast polyester resins are being used on an increasing scale for the manufacture of all types of industrial products. One of those exhibited was an exhaust stack made by Graydon's Industrial and Marine Plastics Ltd. A wide range of hospital equipment is made from their products by Norman Roffe (Poly-glass) Ltd. These include laundry trolleys, house trucks, mobile baths and a wide variety of containers. Similar containers are made for the agriculture, fishing and poultry and other industries.

Two comparative novelties using Orkast were also shown on the stand. These were an operator's first-aid polyester resin and glass fibre repair kit (Acra Whitehall Paints Ltd.) and a polyester film laminated to a notice made by the same company.

Plastics Engineering Companies

Some of the most outstanding exhibits were provided by various plastics engineering companies — firms who produce a wide range of engineering products by moulding and machining plastics. They serve a very useful purpose indeed, not only in providing a service to the engineering industry but also introducing new materials to the industry — which, in turn, helps the polymer industry.

Plastic Engineers Ltd. use such materials as nylon, polythene, polystyrene, polypropylene, acetal resin, rigid pvc and polycarbonate. Their processes include injection moulding, extrusion, machining and contract moulding. One of their specialities is nylon and they process all the common grades including Type 66, Type 6 and Type 11. The material is available as mouldings, extrusions or machined parts and one feature of this material is that very large mouldings are now being made. It is also being used as a bearing material without lubrication and these products are manufactured by the company.

Another famous name in this field is Polypenco Ltd., manufacturers of engineering industrial plastics. In the first instance they supply a range of materials for other companies to machine. These include nylon, ptfe and polystyrene. Other materials handled by this company are the finely divided powders described earlier, and Penton. The nylon referred to is cross linked. One of the more recent and interesting activities of this company is the use of MC nylon. This exclusive new process enables finished nylon parts to be produced directly from monomer at atmospheric pressures, thus eliminating five operations needed in conventional nylon processing methods. Semi-finished stock products are already available in the form of rod, tube, plate and discs. Cast parts can be reproduced in sizes up to 500lb.

Two other products of Polypenco warrant mention. These are the 'Sint' materials which are standard products containing other specially developed constituents. For example, Fluorosint TFE resins have one-sixth the thermal expansion of normal ptfe, dimensional tolerances are also much better and the materials are notably free from all stresses and do not distort on thermal shock. Deformation under load is reduced and bearing

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OVERSEAS AGENTS THROUGHOUT THE WORLD

P4197

wear surfaces show considerable improvement on ptfe. Nylasint is available in a similar way.

The Nylonic Engineering Co. Ltd. is using nylon, polyacetal, polycarbonate and polypropylene in the form of rod, sheet, tube, mouldings, gears, machine parts and extruded sections.

In the field of the more unusual materials, polyacetal (Delrin) is used for gears in a similar way to nylon. However, a greater standard of accuracy can be obtained by moulding or machining due to Delrin's greater dimensional stability. In addition, the material has a natural lubricated surface and running-in lubrication may not be as necessary as for nylon. Delrin is employed for bearings in a similar way. So far as polycarbonate is concerned, this is available from stock as rod and sheet. The same applies to polypropylene. Nylon (in various grades is available in a number of interesting forms including balls, centreless ground material, small diameter nylon tube, rectangular, square and hexagonal, nylon strip machined from sheet, tape, sheet, tubular bar and rod.

One other company in this group, although of a rather different nature, is Thermo Plastics Ltd. One feature of this company's stand was the large injection moulded products including a container in hd polythene (or polypropylene if required) with outside dimensions of 35in. x 21½in. x 9½in. In this connexion, the company has the largest HPM machine in the country — the 300oz. size.

Miscellaneous Aspects

One of the most interesting developments on display was Coofilt by Coopers Plastic Foams Ltd. This was a filter made from a polyurethane foam. The open-cell structure is extremely even and the porosity can be tailor-designed to meet customer's requirements. Filtration in depth is achieved with thicknesses up to 3in. and there is minimum loss in flow rate.

Coofilt has a very high proportion of free air space giving great dust holding capacity which can be further enhanced by oil impregnation. For this reason one of the major fields is expected to be air filtration, particularly in cars and on ships. The filter can easily be cleaned by washing in water or suitable solvents and it is also resistant to many oils and organic solvents.

A different application of rigid, high impact resistant pvc was illustrated by the Distillers Plastics Group. This was a sheath or jacket to the rapidly increasing field of hydraulic pit props. The application is, of course, a vital one, and every care must be taken to produce a first class product. The jacket is tested for impact resistance by free-swinging blows from a sharp-edged 10½lb. hammer swinging through a radius of at least 5ft. The jacket withstands prolonged blows in this way and this highly satisfactory result has been fully vindicated with field trials.

Conclusions

It has only been possible to describe the more outstanding exhibits and trends at the Exhibition. Many products have not been mentioned which are taken for granted. The Tufnol Ltd. laminated products are good examples as are the silicone products of I.C.I. Ltd. and Midland Silicones Ltd. Some of these materials are so well known that they were not shown at the exhibition at all!

The new products are coming along well. It is surprising how we managed with the 'old' materials until two or three years ago. Polyacetal (Delrin), polycarbonate, the new nylons, Penton and ABS are already well established products in the engineering field.

Although the exhibition did not bring plastics out in their best light, at least the possibilities were shown to be great. As this comparatively new exhibition series gathers momentum, plastics products in engineering and design will undoubtedly follow suit. It must not be assumed by manufacturers of established plastics materials, however, that their products need not be displayed — the 2500 year established steel was very much in evidence!

Lubrook and Ferrocite structural parts produced by powder metallurgy techniques by Bound Brook Bearings Ltd.

Inflatable Nylon Raft

A sectional, collapsible raft capable of supporting a load of 10 tons, has been developed by a Southend firm, Lea Bridge Industries Ltd.

It consists of 12 buoyant units made from proofed nylon fabric, held together by a lightweight framework of marine alloy. The fabric is an 8oz. nylon mock leno base cloth coated with neoprene to a total weight of about 30oz./sq. yd.

Intended primarily for the transport of vehicles, the raft has been designed for propulsion by two outboard motors or by towing. Investigation is also being made into the possibilities of towing it by helicopter. Successful beaching trials have been carried out with two leading buoyancy units deflated.

Slight modification enables rafts to be joined end-to-end to form a pontoon bridge or roadway.

Now under trial in the Far East, the Lea Bridge 10-ton raft is the newest of a wide range of inflatable craft now being made from coated nylon fabrics. In addition to life rafts these include yachting dinghies, assault craft, collapsible catamarans and the remarkable Dracone oil-carrying barges.

Programme Change

Cis 1-4 polybutadiene will be the subject of the IRI North Eastern section's meeting on December 4 and not proofing as previously programmed.

The paper will be given by F. Nield at the Eldon Grill, Newcastle, at 7 p.m.

Synthetic Adhesives

RAPID GROWTH IN THE INDUSTRY OVER THE LAST TEN YEARS

ADHESIVES in various forms have been known to man for many hundreds of years and he has readily accepted and utilized their specific properties. The older type adhesives were based on naturally occurring products of animal or vegetable origin. These materials were found to have certain limitations, their main disadvantages being their poor water resistance and susceptibility to attack by mould and bacteria. The synthetic adhesives available today to some extent overcome these problems but it must be emphasized that adhesives based on naturally occurring products have a very high yearly consumption — although in some industries, such as the wood industry, the development of synthetic resins has resulted in the older materials being replaced.

It is probably true to say that the development of synthetic resin adhesives marked an important stage in the transition from glueing as an art to glueing as a science. The consumption of synthetic resin adhesives has been growing quite steadily in this country although it is very difficult to give accurate figures. In the USA consumption is also rising steadily and in 1958 it was reported that over 20,000 tons of phenol-formaldehyde and 40,000 tons of urea-formaldehyde resins were used for one specific application alone in the manufacture of plywood.[1] In total this represents an increase of over 20% in four years from 1954 and it is believed that this growth rate is continuing along the same lines. It is interesting to look at the figures given in Table 1 issued by the US Census of Manufacture 1954.

TABLE 1

*Synthetic resin types**	*Millions of pounds*
Phenolics	134†
Ureas	181†
Vinyls	66
Nitrocellulose and related materials	13
Total	394
Natural gums and resins (not rubber)	26
Dextrine and starch	244
Animal glue	109
Others	197
Grand total	970

* Including solvents
† Not including laminating resins

Following on the first of the thermosetting synthetic resin and adhesives came the development of a group of materials known as the 'epoxides'. These materials exhibit excellent adhesion and certainly their main advantage is their ability to cure with no by-products which of course minimizes shrinkage. The consumption of the epoxy resins in this country for adhesives is not great at present but the potential is certainly high. In the USA for 1958 the total epoxy market was around 15,000 tons and the total consumption of epoxies for adhesives was only in the region of 2% of this figure. The consumption of epoxy resins in this country has been increasing from 10 to 15% a year since 1954.[2]

Rubber adhesives are a very important group of materials and their consumption has grown quite steadily over the last ten years or so. The shoe-making industry is a large user of these adhesives for sticking soles to uppers. The properties that these materials offer are quick-stick, flexibility, water resistance and performance. It has been estimated that 5% of the world's total rubber consumption goes into adhesives.[3] Other consumers of these adhesives are the building, clothing and the motor car industries. It has been reported that every day 4,300 gallons of rubber adhesive are used by the motor car industry for applications such as bonding felt linings, trimmings and sticking seat upholstery and 'undersealing' of car bodies.[4]

Recent developments include pressure sensitive and synthetic melt adhesives. Materials that are used for the synthetic melt adhesives include polyvinylacetate, polystyrene, polyamides and polythene. A group of materials that are arousing interest in the pressure sensitive field are the silicones and they will be described later in the paper.

Why Do Adhesives Stick?[5]

To both the scientifically-trained man and the layman no completely satisfactory answer has been given. Many opinions have been voiced, based on both a theoretical approach and as a result of practical experiences. It has been shown that if there are two smooth adherends such as glass and metal and a solidifying adhesive is to be used it must have the following properties.

(a) It must wet the adherends
(b) The internal stress produced on solidification must not be high.

These rules may be applied generally to solidifying adhesives with smooth adherends. Typical solidifying resins would be the urea formaldehyde and phenol formaldehyde types.

If the surfaces of the adherend are rough as with wood then other forces such as mechanical interlocking occur and wetting may cease to have any significance.

The factors that influence adhesive action have been broadly grouped as physical and chemical.[6]

Some of these factors are listed.

Physical

(a) Surface tension of adhesive.
(b) Porosity of the surfaces being bonded.
(c) Physical properties of adhesive film (tensile strength, shear strength, compressive strength, modulus of elasticity and creep rate).
(d) Relative thickness of the adhesive film and its viscosity.
(e) Method of applying the adhesive.

Chemical

(a) Polarity of the surface being bonded and the adhesive materials.
(b) Processes of polymerization, formation of by-products, and influence of molecular weight.
(c) Nature of side grouping on polymer chain.
(d) Thin films of gases or vapours absorbed on the surface of the solids being bonded, and adsorption by adhesive film.
(e) Evaporation or diffusion of volatiles from adhesive film.
(f) pH of the glue line.

Adhesive Bonding Preferred

The following are some reasons why adhesive bonding may at times be preferred to some of the more conventional methods of joining surfaces.

(1) Ability to convert small pieces such as off-cuts into large shapes.
(2) Only a small amount of adhesive normally required.
(3) Makes possible the joining of shapes and materials that cannot be joined by other methods due to thinness and fragility.
(4) Avoids the use of screws, nails,

rivets or welding for joining surfaces.

(5) Gives lighter weight constructions.

(6) Avoids necessity of employing highly-skilled labour as would possibly be required with welding and other methods.

(7) May also form a moisture barrier.

(8) Increases the scope of designing.

(9) Produces a more attractive and neater joint.

(10) Non-requirement of specialized tools to carry out 'on the spot' bonds.

The resins may as usual be classified into two groups (a) thermoplastic and (b) thermoset. The thermoplastic types may be re-softened by heating many times over after having set in the cold. This distinguishes them from the thermoset which when cured by heating with a catalyst remain infusible.

Because of their tendency to lose bond strength due to their relatively low softening points and to creep when subjected to stress over long periods, the thermoplastics resins have not commanded the amount of interest as shown to the thermosets by industry. However, more and more applications are being developed for the thermoplastics, for example melt adhesives, and they will no doubt soon be increasing in consumption. These figures, it is thought, will never approach those of the thermosets.

The adhesives used in industry are now described and the more important members of the following groups, thermosets, thermoplastics and rubbers are mentioned.

Urea and Melamine-Formaldehyde

These synthetic resin adhesives have been prominent for many years since they first became commercially available about 1935. They were to be followed by adhesives of the phenolic family. The melamine types have better heat stability and greater resistance to water than the ureas but, however, are more expensive and are finding applications as a co-condensate with urea-formaldehyde.

The major outlets for these adhesives are for laminated wood, plywood, impreg and compreg, and chipboard.

The urea is normally reacted under alkaline conditions to give mono- and di-methylol ureas; when this reaction is complete the materials are acidified and dehydrated under vacuum to give a solids contents around 70%. The resins are normally hardened by acid or acid generating substances such as ammonium chloride, diammonium phosphate and phosphoric acid. The urea-formaldehyde and co-condensates may be obtained as liquids or solids.[7] These resins may be modified by addition of: (a) fillers (starch and rye flour), (b) glue line pH control additives (zinc and magnesium oxide), (c) fortifying agents (phenyl guanazole, resorcinol), (d) anti-crazing agents (woodflour, calcium sulphate plaster).

British Standards

The plywood industry is responsible for a considerable consumption of both urea and phenol formaldehyde adhesives. These materials are designated according to the performance of the adhesives used in their construction (see British Standards 1203 and 1455).[8] BS 1203 quotes the standard for synthetic resin adhesives used for plywood making and BS 1455 the standard for plywood. BS 1203 specifies three types of adhesives.

Type WBP: Weather and boil-proof. These are adhesives that by systematic tests and by their record in service have proved indestructible by weather, micro-organisms, cold and boiling water, steam and dry heat. Such glues are more durable than the wood itself.

Type BR: Boil-resistant. These adhesives have good resistance to weather and to the boiling-water test, but they fail under prolonged conditions of full exposure to weather for which the WBP adhesives are satisfactory. They will withstand cold water for many years and are highly resistant to micro-organism attack.

Type MR: Moisture (water)-resistant. To this group belong those glues that will survive full exposure to weather for only a few years. They will withstand cold water for a long period and hot water for a limited time but fail under the boiling-water test. They are highly resistant to micro-organism attack.

The plywood specification names these three qualities of adhesive and specifies that the plywood shall be appropriately marked Bond WBP, Bond BR or Bond MR, according to the adhesive chosen. In practice, it usually works out that phenolic resin is used for the highest grade, melamine-fortified urea for the second and urea for the last.[9]

For the better grade plywoods the phenolics are preferred but extensive use of urea-formaldehyde is being made in furniture glueing and chipboard manufacture.

Phenolic Type Adhesives

The use of phenolic resins has been growing steadily over the past 15 years although their commercial adaptation was slow in getting started.

The phenolic adhesives are normally prepared by the alkaline condensation of the lower monohydric phenols, resorcinols or combinations as shown in Fig. 1.

The plywood adhesives are normally resols made by reacting phenol with a large excess of formaldehyde in a strongly alkaline medium.[10]

Initially the only phenolic adhesives available were in film form which required both high pressures and temperatures. These resin adhesives may be used without the addition of a hardener in which case it is essential to apply pressure at a temperature of about 135°C. to cure the resin and so ensure that the water of condensation is squeezed out. Lower pressing temperatures may be used by the addition of a few per cent. of para-formaldehyde usually mixed with about 10-20% of coconut shell flour. This enables temperatures as low as 115-120°C. to be used and even lower temperatures may be used if resorcinol and para-formaldehyde are added.

Phenolic adhesives find most of their uses where moisture resistance and durability are essential. Most of the plywood used during the last war was made from phenol-formaldehyde resins and the major uses of this material today include the bonding of various types of laminates and wood chips.

Resorcinol resins are also members

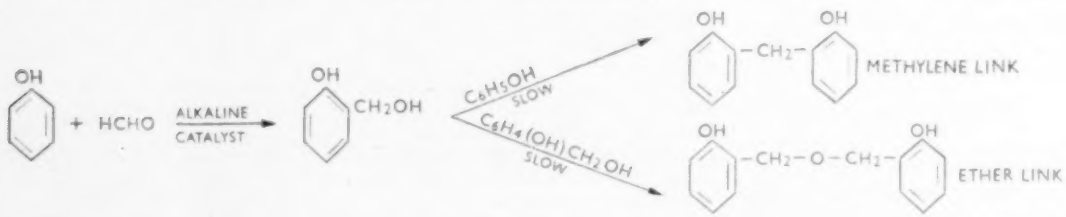


Fig. 1

BEHIND THE DUNLOP SYMBOL

What does Dunlop sell? Tyres. That's true. But tyre valves, too... millions of them each year... the rubber lining for a complete reservoir... two hundred different kinds of rubber mouldings for the aircraft industry... basketball boots... disc brakes... conveyor belting... And these are only a few of the thousands of products marketed by Dunlop, in 1960 to the sum of £275 million. A record turnover, and the product of steady growth. The organisation behind the new Dunlop symbol is one of the most enterprising and progressive in the world.

DUNLOP SYMBOL OF PROGRESS

of this group. They are dihydroxy compounds and, as would be expected, they prove more reactive than phenol with formaldehyde. Such resins, prepared from reacting resorcinol with formaldehyde, provide low temperature setting adhesives and are used in combination with phenolics. The resorcinol resins are fairly expensive and are normally supplied in solvents and may be hardened by the addition of paraformaldehyde which supplies the additional methylene bridges. The shear strength obtained from bonding with these resins is excellent and they also exhibit excellent water and weather resistance.

The phenolic type synthetic resin adhesives are very useful materials and their properties have been quickly seized upon by the wood industry. The consumption of this group of materials is being increased by the alloying of other polymeric materials with phenolic resins. Alloys that have found use as adhesives are those of phenolic with epoxy resins, rubbers, polyamides and polyvinyl butyral, formal and acetate.

Vinyl Adhesives

The use of vinyl adhesives has been growing quite steadily over recent years. It is probably true to say that the most important member of this group in this country is polyvinyl acetate.

Vinyls are normally employed as solutions or emulsions and have a high initial tack. They are therefore suitable for bonding porous cellulosic materials, paper, leather and wood. The wood industry does not consume a great deal of this material mainly because the synthetic resins are fully entrenched. Their main advantage over many of the synthetic resins is the fact that they do not require a catalyst or a hardener and thus there is no problem of controlled pot-life.

Polyvinyl Acetate

Polyvinyl acetate is prepared by the polymerization of vinyl acetate monomer as shown in Fig. 2.

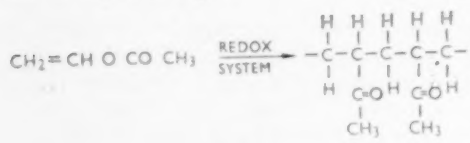


Fig. 2

The material is obtainable in three forms namely: (a) bead polymer, (b) solution polymer, (c) dispersion or emulsion polymer.

They may be externally plasticized by materials such as dibutyl phthalate, etc. The quick bonding characteristics of polyvinyl acetate emulsion adhesives allow high output rates and are, therefore, displacing natural adhesives in many packaging applications. It has been found desirable to use large quantities of polyvinyl alcohol in these emulsions to enhance adhesion, particularly to cellulosic substrates.

The main disadvantage of these adhesives is their requirement of heat, this is essential if in solution or emulsion form, in order to ensure removal of volatiles. Force drying has to some extent overcome this and many other developments have helped to fully establish this material as an adhesive.

Polyvinylchloride/acetate Copolymer

The uses of this material are not as widespread as those of the homopolymer polyvinylacetate. Suggested uses include optical cements and the production of photoflash bulbs.

Polyvinyl Acetals

Many of this group exhibit flexibility, toughness and good adhesion properties. In particular polyvinylbutyral possesses a high specific adhesion to glass surfaces.

The use of polyvinylbutyral as an interlayer has been widespread in the preparation of safety glass. Polyvinylbutyral and formal have also found applications in the wood and leather industry. These polymers have their thermoplastic characteristics changed to some extent by the addition of a phenolic resin and this will tend to raise their softening point.

Acrylic Adhesives

The use of these materials as adhesives has not been extensive although there has been a limited application in safety glass. Some use of acrylic adhesives has been made in the bonding of expanded polystyrene.

A recent development in this group is that of an adhesive based on a cyanoacrylate monomer.[11] This material is a very versatile bonding adhesive modified with a thickening agent and a plasticizer. Cyanoacrylate monomer is prepared by reacting a cyanoacetate with formaldehyde in the presence of a basic catalyst (sodium hydroxide, piperidine, diethylamine, pyridine, etc.) at 50-90°C. and a solvent (monohydric alcohols, aliphatic ethers, benzene, etc.).

Rubber Adhesives

Rubber adhesives have found many applications in a wide variety of industries and although at first glance the figures of the total consumption being only 5% of the world rubber production appear low, however, when quoted on a weight basis the figure is high. Both natural and synthetic rubbers and their many derivatives have been used in the preparation of a whole variety of adhesives. The popularity of rubber adhesives is, of course, due to a combination of properties not usually exhibited by the other classes of adhesive mentioned in this paper. These properties are flexibility, dry tack, elasticity, resistance to vibration and high specific adhesion to certain surfaces.

Many elastomeric materials are used as adhesives, including natural rubber latex, oxidized rubber, chlorinated rubbers, polychloroprene (neoprene cements) and rubber hydrochloride, cyclized rubber, polysulphides, hydrogenated rubber, acrylonitrile, silicones (rubber pastes and dispersions), phenolic modified rubbers, solutions of above rubbers, reclaimed rubber.

The advent of synthetic rubbers has witnessed the development of chlorinated rubber adhesives. These adhesives are suitable for bonding various rubbers such as neoprenes and butadiene-acrylonitrile to wood and metal surfaces.[12] Many of the rubber adhesives exhibit one or more specific property and at times it can become a difficult matter in choosing any one adhesive. The solvents that are normally used are those based on coal tar and petroleum fractions, chlorinated hydrocarbons such as carbon tetrachloride and trichlorethylene.

The polysulphides are an interesting group of materials and exhibit excellent adhesion to a variety of materials. They can be compounded to yield a strong elastic bond to glass, ceramics, aluminium, wood, steel, plastics, etc. Adhesive properties are generally developed through the use of phenolic resins.

Where good bond strengths and maximum heat resistance are required silicone elastomer pastes or dispersions may be used.

It is true to say that rubber adhesives have a sphere of use all their own and although they are meeting greater competition from the 'plastic' type adhesives such as polyvinylacetate, phenol - formaldehyde/polyvinyl butyral, polyamide/epoxy, and epoxy/polysulphide, their potential remains high.

Epoxy Resin Adhesives

The first epoxy resins were developed independently by Castan in Switzerland and Greenlee in the USA around 1938. The commercial availability of epichlorhydrin after World War II led to the rapid commercial exploitation of these resins.

The epoxy resins are produced from Bisphenol A and epichlorhydrin. Chemically the epoxy resins take the general form shown in Fig. 3.

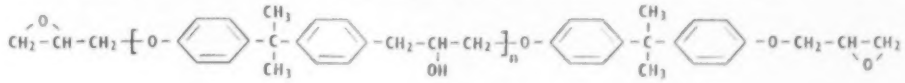


Fig. 3

These resins may be cured by a variety of compounds designated hardners or curing agents. They may be either room temperature or high temperature curing agents. The materials normally used are amines, amine adducts, organic acids, acid anhydrides, boron trifluoride and resinous materials such as the polysulphides and polyamides.

Epoxy resin adhesives exhibit outstanding properties such as toughness, chemical resistance and low shrinkage. They have excellent adhesion to metals, glass, china, stone, concrete, most natural organic substances, and to many synthetic plastics materials. The combination of excellent adhesion and absence of shrinkage on setting make these materials admirably suitable in structural applications and for complex assembly systems. Actual bonding operations do not require highly-skilled personnel and this adds to their attractiveness.

The cured epoxide has no smell or taste and it therefore becomes eminently suitable for bonding broken crockery and glassware. Such articles repaired by glueing with an epoxide will stand up to very rough usage including repeated immersion in boiling water.

The main disadvantages are their high viscosity and comparatively high price. The epoxy resin adhesives are in the region of three times the price of the urea and phenol formaldehyde synthetic resin adhesives.

Liquid Polyamides (Versamids)*

These are members of a large family of thermoplastic polymers. They range from hard, brittle, relatively inert resins through tacky, gum-like materials to reactive pourable fluids. They contain polar amine, carboxyl and amide groups. These polar groups contribute greatly to adhesion to many surfaces, both metal and non-metal, with best adhesion to polar materials.

They are prepared by the condensation of polymerized linoleic acid with polyamines, shown in Fig. 4.

It has already been shown that epoxy resins are excellent adhesives. When reactive liquid polyamides and epoxies are combined superior adhesion and flexibility results. On mixing these two different types of resin a chemical reaction occurs between the amine groups of the polyamides and the epoxide groups of the epoxy resin as shown in Fig. 5, leading to ring rupture and addition.

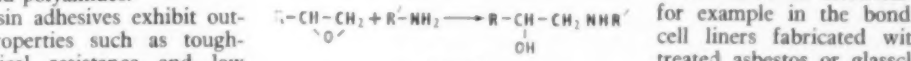


Fig. 4

Fig. 5

This combination of resins will cure and harden without the addition of external curing agents. The resulting bonds have high shear strengths, exhibit excellent resistance to impact and mechanical shock, low shrinkage and high dimensional stability.

This resin combination system exhibits excellent adhesion to a wide variety of surfaces such as aluminium, steel, copper, brass, etc. It is also effective with non-metals such as glass, wood, ceramics, leather and many polymeric substances. They have also found an outlet in pressure-sensitive tapes.

Silicones Adhesives

Silicones were first manufactured in this country in 1954 by Midland Silicones Ltd. They are essentially high-priced materials and this to some extent has limited their development in the adhesive industry. The average industry has shown a great amount of interest in silicone adhesives mainly of the pressure sensitive type. One such material is Silicone Adhesive MS 2704†, a pressure sensitive adhesive which will maintain its bond strength after being exposed to temperatures ranging from −55 to +250°C. This adhesive exhibits excellent adhesion to metals, glass, paper, fabrics and plastics including polythene, ptfe, and Melinex film. It will also adhere well to such non-adhesive materials as silicone rubber, laminates and varnishes.

The main use of this adhesive is for heat-resistant pressure-sensitive tapes. An example of such tapes is in the wrapping of many types of electrical coils including those designed for Class H insulation where it is necessary to withstand hot-spot temperatures of 180°C.

The properties of this silicone adhesive have led to its use in the aircraft and electronic industries as a bonding agent to facilitate assembly of small parts prior to installation; it is also used in electrical equipment for example in the bonding of slot cell liners fabricated with silicone-treated asbestos or glasscloth and as a bond for silicone rubber-coated glasscloth taped conductors.

The adhesive does not, however, offer any particular advantage in the preparation of normal masking tapes. It is often difficult to paint surfaces from which the tape has been removed unless the surface is thoroughly cleaned with solvent. It is not recommended for applications involving exposure to high concentrations of solvent vapours or oils.

The materials are expensive and are in the region of 20s. per lb. which is twice as expensive as the epoxies and over six times the price of the urea and phenol-formaldehyde resins.

Conclusion

The adhesive industry undoubtedly has grown quite rapidly over the past ten years. Many industries have been quick to utilize the materials available and large tonnages are now used every year. The requirements of specialized industries such as the aircraft and guided weapons are forever seeking adhesives that will withstand subnormal temperatures without failure. The epoxies and various blends are meeting many of their requirements but at temperatures over 400°C. these industries still have to rely on inorganic type adhesives based on ceramics. Further developments with the silicone and fluorine containing polymers, as well as with inorganic polymers will we hope to a large extent meet their stringent requirements.

The use of phenol and urea-formaldehyde in the wood industry is now firmly entrenched but some use is also being made by this industry of the epoxy and polyvinyl acetate adhesives.

The growth in the consumption of rubber adhesives is continuing and it

Continued on page 843

* Registered trade name of General Mills Inc.

† Registered trade mark of Midland Silicones Ltd.

Shell's New Plastics Laboratory

FULLY EQUIPPED FOR TECHNICAL SERVICE AT CARRINGTON

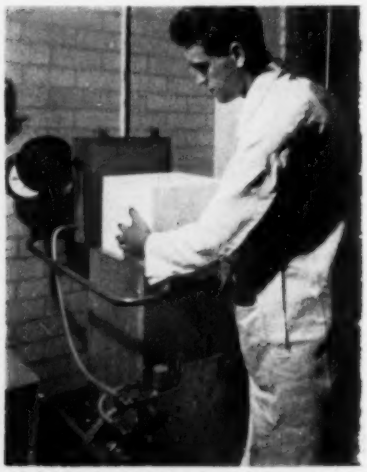
THE new plastics research and development laboratory at Shell Chemical Co. Ltd.'s Carrington complex is now in full operation. It provides technical service and advice to UK customers, but in addition it is also a development laboratory where new grades of thermoplastics — and modifications of existing grades — are tested.

Work started on the laboratory in April 1960 and was completed in the short time of 15 months. Cost was about £300,000. Equipment — ranging from extruders and injection moulding machines to impact testers and a nuclear magnetic resonance spectroscope — has been installed at a cost to date of £100,000.

The plastics laboratory is actually sited within the manufacturing area next to the new polyolefin plants which will produce 15,000 tons of low density polythene, and 15,000 tons of hd polythene alternatively with polypropylene, and near the polystyrene plant.

Shell's policy of using its plastics products in its own buildings where it is technically and economically desirable has been followed. The laboratory manager, J. Hartley, worked with the architect, Ronald Fielding, directly in deciding on 35 applications.

These include ld polythene waste pipes and fittings; polypropylene sinks; expanded polystyrene insulation; pvc/steel and pvc/asbestos exterior panels; high impact pvc gutters and down pipe and hd polythene cisterns.



A block of expanded polystyrene being removed from an experimental steam-heated mould

Fixing and protection of the plastics materials was given as much study as the initial choosing of the materials. A typical passage from a report on the construction reads: 'The pvc flooring was very easily site welded but some movement tolerance was required under the perimeter skirtings to allow for dimensional changes for approximately a week after laying. In some cases the sealing of the floor did not follow immediately and cleaning was difficult. PVC skirtings were not selected as it was felt that they could not be integrated with the special skirting trunking'.

A very well equipped machine hall covers all aspects of processing and fabrication, including the production of blown film and monofilament. This means that customers' processing can be accurately duplicated in technical service work.

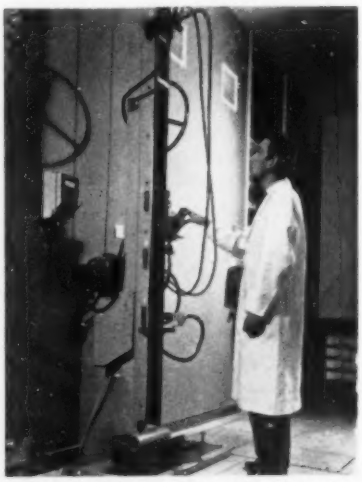
So far as testing is concerned, in addition to standard tests on moulding powder, applicational tests are carried out on finished articles. Much work — including UV accelerated ageing tests — is being done on pipe.

A fully-fledged workshop produces equipment for the laboratory — including dies and moulds — and for the two pilot plants at Carrington, one of which is at the moment producing polyols for isocyanates.

As previously indicated one function of this new laboratory is the industrial development of certain aspects of the work of the Carrington Research Laboratory. At present a large part of the work of this research laboratory is spent on Zeigler/Natta low pressure polymerization of olefins. The reaction mechanism is being studied in attempts to improve the efficiency of the catalyst system.

Research on polystyrene is concentrating on the development of grades with improved physical and processing qualities. Investigations cover new types of copolymer based on free radical catalysis and stereospecific polymers and copolymers prepared by the Zeigler/Natta route.

In the industrial chemical field an increasing amount of effort is being devoted to alkylene oxides and their derivatives. Much of the work at present involves studies of the chemistry of alkylene oxide polymers, and research in the laboratory has played a large part in establishing the manufacture of a number of polyurethane foam intermediates. At the same time studies of the technology of polyurethane foam has assisted in the development of a flexible foam with improved properties.



Falling weight impact tester for pipe and sheet. Both this and the mould in the other picture were designed in the Carrington Plastics Laboratory

The new plastics laboratory at Carrington adds to the claim that it is one of the world's most fully integrated polymer centres. The group's research and technical service on polymers functions in three countries:

UK

Carrington Research Laboratory: research and development of manufacturing processes.

Carrington Plastics Laboratory: technical service and development.

Holland

KSPLD (Koninklijke Shell Plastics Laboratorium, Delft): technical service in plastics, rubbers, and resins on the Continent, and long-term development on all group plastics.

Koninklijke Shell Laboratorium, Amsterdam: the Group's research laboratory in Amsterdam. This includes in its work fundamental research on high polymers.

USA

Shell Group Laboratories whose work includes plastics development in many fields are located at Emeryville and Torrance in California, Houston in Texas, Union in New Jersey and Woodbury, also in New Jersey.

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Ageing Symposium at Welwyn

WORK AT NRPRA HELPS SOLVE PRACTICAL PROBLEMS

THE aim of the recent symposium on fundamental and practical approaches to ageing held at the laboratories of the Natural Rubber Producers Research Association was outlined by Dr L. Bateman, director of research, in his opening remarks.

The idea, he said, was to select a broad field of research and to outline the several ways, often mutually impinging, in which NRPRA scientists were tackling the problems presented. Both from its intrinsic importance as well as so fully exemplifying the value, and indeed the necessity of a multiple attack, the subject of the symposium could not be bettered. It was important to emphasize the need to study both chemical and physical effects as the ageing of rubber reflected such an intricate interplay of chemical and physical phenomena.

It was, concluded Dr Bateman, remarkable that the advances in the knowledge of the fundamentals of the behaviour of rubber over the last few years, while appearing generally quite small and undramatic when taken singly, were of great significance when taken together. He hoped that this would be more apparent after the symposium and that the possibilities for no less significant advances lay in the near future.

Fundamental Approach

The first paper of the symposium was on the fundamental approach to the study of ageing, and was delivered by Dr J. I. Cunneen.

The ageing of a vulcanizate, he said, was different from that of the base polymer, and varied with the vulcanization recipe and curing conditions. Ageing depended critically upon vulcanizate structure and therefore before its chemistry could be investigated it was necessary to examine the constitution of vulcanized natural rubber. Work carried out at NRPRA had shown that three main types of sulphurated structures were present in vulcanized natural rubber — cyclic sulphides, alkyl alkenyl sulphides, and di-alkenyl sulphides. Chemically therefore a vulcanizate could be regarded as mainly a polyisoprenic hydrocarbon admixed with small amounts of sulphur compounds of the above types.

In order to obtain precise information about the chemical processes occurring during ageing, it was necessary to work with a 'model' system, and a mixture of squalene and small amounts of sulphur compounds had been found to simulate closely vulcanized natural rubber in oxidative behaviour. The investigation had therefore proceeded as follows: (i) examination of the autoxidation of squalene and allied olefins; (ii) examination of the autoxidation of simple organic sulphur compounds; and (iii) examination of the co-oxidation of squalene and sulphur compounds. As a result of these studies the main features of the chemistry of the co-oxidation system were now understood. Interesting features found during the course of this work were: (i) some sulphur compounds inhibited autoxidation, (ii) the 'true' inhibitors were sulphoxides and thiolsulphinates, (iii) their mode of action was quite different from that of conventional inhibitors, and (iv) the results had proved useful in the interpretation of data obtained directly from vulcanized natural rubber by the stress relaxation technique.

Dr L. Bateman, director of research, addressing the delegates to the NRPRA symposium on ageing

Comparing Vulcanizates

Dr J. R. Dunn then read a paper on the ageing characteristics of different vulcanizates. He said that thermal and photochemical ageing of vulcanizates could occur both in presence and absence of oxygen and only the ageing induced by oxygen could be protected by additives. Ageing characteristics were conveniently studied by measurements of stress relaxation since the amounts of degradation and cross-linking during ageing could be separately deduced from them. Ideally a vulcanizate should neither degrade nor be cross-linked during service.

This ideal was closely approached by peroxide vulcanizates. When purified by extraction, peroxide vulcanizates of natural rubber were degraded by autocatalytic oxidative scission of the polyisoprene chain, but this degradation could be prevented by antioxidants. Non-oxidative degradation was very small and there was little cross-linking during ageing. Radiation vulcanizates exhibited similar ageing characteristics, but in this case care must be taken to employ antioxidants which were not destroyed during the irradiation.

Some vulcanizates containing sulphur in the cross-link had similar characteristics. TMT vulcanizates were well known for their superior resistance to ageing which was attributable to the presence of a powerful antioxidant, zinc dimethyl dithiocarbamate, produced during vulcanization, coupled with the absence of non-oxidative degradation. When freed of antioxidant, TMT vulcanizates underwent autocatalytic oxidative scission without concurrent cross-linking. MBT-accelerated sulphur vulcanizates could also be prepared which had ageing characteristics like those of TMT vulcanizates, but, in general, sulphur-accelerator vulcanizates had less desirable ageing characteristics. Sulphur - accelerator vulcanizates underwent network rearrangement in the absence of oxygen due to cleavage and reformation of polysulphide cross-links and this frequently occurred more rapidly in the presence of additives. This rearrangement led to undesirable permanent set and also to some loss of cross-links since the reformation reaction was not 100% efficient.

Activators for Latex

The subject of the lecture by M. W. Philpott was developments in the use of vulcanization activators for latex systems.

Many industrially important accelerators, he said, contained sulphur combined as C-S, S-S or N-S. Such compounds strongly accelerated the vulcanization of rubber by sul-

phur at the temperatures normally employed for vulcanizing dry rubber (approx. 140°C.), but at low vulcanizing temperatures (approx. 100°C.) their accelerative power was of an extremely low order. To account for this behaviour the assumption was made that accelerators of the type considered must first undergo scission at the S bond before they could exert any accelerative action, and that this process normally occurred at a negligible rate at 100°C. or lower.

Since it was known, said Mr Philpott, that certain thioanions $R'S^-$ promote rapid heterolytic scission of S-S bonds it was reasonable on this assumption to expect that such reagents would enhance the accelerative action of disulphide accelerators at low temperatures. Experiment had borne out this prediction and had shown moreover that not only disulphide accelerators XSSX but also monosulphide XSX and sulphenamide $XSNR_2$ accelerators were susceptible to activation by $R'S^-$ reagents, notably by thiourea and some of its N-substituted derivatives.

This observation had led to the development of accelerator combinations which were active enough at low temperatures to replace dithiocarbamate accelerators in situations where the copper staining propensity of the latter was objectionable. Such combinations were of particular interest for vulcanizing latex-textile products in which the textile material was a likely source of copper contamination.

The activating effect of thioureas was also strikingly illustrated by their capacity to accelerate the vulcanization of rubber by so-called 'sulphurless' systems. Vulcanization by tetramethylthiuram disulphide (TMTD) — zinc oxide was normally practicable only at relatively high temperatures, *e.g.* 140°C., but in the presence of thiourea vulcanization proceeded rapidly at 100°C. or lower. Furthermore, excellent vulcanizates could be produced without either elemental sulphur or thiuram disulphide; for it was found that in the presence of thiourea-type activators sulphur for cross-linking could be provided by a variety of organic disulphides and sulphenamides.

The discovery of ways of effecting rapid vulcanization by TMTD under mild conditions greatly facilitated the development of latex compounds which were to be used in applications where exceptional resistance to heat was required. An unexpected property of rubbers vulcanized by activated TMTD systems was that they not only tolerated but were strongly protected by small amounts of copper.

Flame Resistant Latex Compounds

Flame resistant natural rubber latex compounds were described in a paper by T. D. Pendle and E. G. Poole, delivered by Mr Pendle.

He described a new method of improving the flame resistance of natural rubber which involved chemical modification of the rubber molecule with a polyhalogenated organic compound. The preferred modifying agent was trichlorobromomethane which could be added to natural rubber with high efficiency. This method of halogenating rubber had an advantage over simple bromination or chlorination in that four halogen atoms could be combined with each rubber double bond.

The modifying reaction was conveniently carried out in the latex state, and the modified latices thus produced could be used in most of the applications of natural rubber latex. The laboratory preparation of flame resistant latex foam and rubberized hair articles had been carried out and the properties of these products were likely to be of considerable interest.

The lecture on the protection of natural rubber compounds against ozone cracking, delivered by Dr L. Mullins, was a model example of how a technical paper should be presented. The standard of the lectures delivered at this symposium was generally high but Dr Mullins' contribution stood out and that he had his audience's attention was evidenced by the lively discussion which followed.

A better understanding of the mechanism of ozone cracking, he said, had recently been achieved by Braden and Gent who studied the initiation and propagation of a single crack. They had showed that firstly a minimum or 'critical' strain was necessary for ozone cracks to grow at all and secondly there was a well-defined rate of growth when the critical strain was exceeded. Further, among the many substances which provided protection against ozone, two entirely different modes of action were recognized.

Certain antiozonants exemplified by 6-ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline (ETDQ) reduced the rate at which the crack grew (by a factor of about four). Others exemplified by p-phenylene diamine not only reduced the rate of crack growth but acted far more dramatically by increasing the critical stress necessary for crack initiation. This increase might be a factor of 30 or even more, but it was a function of ozone concentration and was very small at concentrations above a well-defined critical concentration.

In proceeding to the formulation of practical protective systems for natural rubber it had to be recognized that service conditions were rarely simple but generally involved a complicated interplay of various stress conditions and failure. Different types of protective systems were often required for different conditions, for example, the strain in the rubber and whether it was static or dynamic.

Preferred protective systems for natural rubber subjected to various types of exposure had now been developed. These included exposure to ozone under: static strain, interrupted static strain; dynamic strain; interrupted dynamic strain; and fatigue due to repeated deformations under conditions where ozone attack was of small importance. The overall results showed that by the careful selection of fillers, curing system and protective agents it was possible to produce natural rubber vulcanizates eminently suitable for many applications in which there was exposure to ozone.

Continued on page 843

The lecturers at the ageing symposium held at the Welwyn Garden City laboratories of the Natural Rubber Producers' Research Association were *(left to right)* **M. W. Philpott, T. D. Pendle, Dr L. Mullins, Dr J. R. Dunn, Dr J. I. Cunneen and Dr A. G. Thomas**

VIEWS *and* REVIEWS

THIS week there seem to be a lot of high politics mixed up with the high polymers. No doubt this is better than high explosives.

Industrial Planning

The major ideas which divide us and nourish our disputes are fairly evenly divided among us but there is a large body of 'floating' opinion whose weight is thrown, now here, now there. One result is an apparent pendulum in economic and industrial affairs.

At the present time, for instance, we in Britain are going back to a period of national planning. Even its opponents are trying either to accommodate themselves to a popular notion, or to find a new name for it, or to persuade themselves that there is a difference between planning and controls. Its proponents, aware of the almost instinctive antagonism which the idea can arouse, are cautiously proceeding from positions of clear agreement to those of obvious desirability and *force majeure*.

That we shall have to accept a measure of large-scale planning for British industry seems certain. Technology has made not only possible but inevitable the creation of ever larger industrial units and we are now accustomed to maintain them by planning weeks, months, years ahead. In fact, only by knowing fairly accurately what our scale and type of output will be for a long time ahead can modern mass production properly function.

The setting up of the Common Market in Europe has forced on its constituent countries a new level of organizing in which industrial planning is an essential feature, so that in this way France, for instance, is now in some ways more highly organized industrially than Great Britain.

Polymer Industry Planning

Our own industry is looking with some anxiety towards expected Government action in the near future. With some hope, too, for we all want to get off the see-saw of alternate expansion and restriction which we have been forced to play on for so long. We want to be able to see a bit further ahead than we have recently been allowed.

Centrally situated as the polymer industry is, sprawling into and across other industries, drawing on and even including in its own sphere of operations the activities of large producers of basic raw materials, converting them into components for other industries to use or even for direct sale to the ultimate consumers, internationally organized and financed, it is rightly concerned as to just where it will be placed in the scheme of things to come, with whom it will be made to lie down, to which of the great sections of industry and commerce it will be tied.

Engineering or Chemicals?

Federation or co-operation has not yet gone far enough — if indeed it ever will — to constitute us a chief industrial group, clearly distinguishable and self-sufficient. But our future may depend on the group with which we are associated.

All things considered, more is to be said for making us a sub-division of the chemical industry rather than of the engineering or electrical or motor industry.

Technologists have ideas on this if only because their own work has made these decisions necessary. Industrial management, whose work is rooted much more in the future than the past, needs consulting because our industrial capacity, output, and techniques are at stake. The political, economic, and financial experts, who have assumed the responsibility for such decisions in the past, have demonstrably not been strikingly successful at it.

Standards and Planning

Other aspects of international co-operation, including membership of the Common Market, which are of concern to British, among all the other, technologists and works managers, are broadly comprised under the term standards. We must all learn to standardize.

Nothing seems so obviously desirable yet so difficult to attain as international standards — unless it be international disarmament. I have several times referred to the valuable work of standardization being done by the European Tyre and Wheel Technical Conference under the guidance, from the British side, of L. J. Lambourn. Work is going on also, laboriously and patiently, in several fields of international standardization for plastics and rubbers — on the rubber side, with which I am most familiar, under the leading of J. M. Buist and J. R. Scott.

Feeding these internationalists with material from the British experience are, along the one line, the technical work of the Tyre Manufacturers' Conference and, along the other, the Federation of British Rubber and Allied Manufacturers through its Technical Committee, whose chairman, F. H. Puxty, and secretary, Miss C. H. Chenhalls, are unobtrusively responsible for much good work on standards and especially designing and applying them intelligently.

One of those minor but particularly knotty problems of standardization on which British industry will soon have to take a decision, is the use of the metric system in weights and measures. Presenting no difficulty, of course, to technologists (who, indeed, have now got beyond tens and are learning to count in twos), the metric system will produce loud repercussions in industry and almost deafening impacts in domestic life. But we shall get used to it.

Translations from the Russian

I am reminded of another form of international cross-linking. A handful of new translations from the Rubber and Plastics Research Association made me realize again what a valuable service this is. They are marked — I almost wrote 'distinguished' — by a meticulous accuracy in translation and they have another recommendation in that, in the nature of things, they are selected by the importance of their subject matter.

I choose three, all translated by R. J. Moseley, for comment.

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **F. C. JENNINGS**

Adhesion

No. 919 is a translation from the Russian and deals with the degrees of adhesion between a variety of ten elastomers and five high-polymeric materials: Cellophane, polythene, polyamide, polyisobutylene (coated onto fabric), and a butadiene—acrylonitrile rubber. There were, thus, 50 experiments.

Three types of adhesion were distinguished: 'cohesive', 'adhesive', and 'mixed'. There appear to be several factors contributing to good bonding: molecular weight, degree of branching, polarity.

Polythene was found to be notably poor in adhesion.

Compounding Ebonite

No. 920 deals with the effects on the physical properties of ebonite of adding various synthetic resins, including pvc, polythene, polyisobutylene, high-styrene rubbers, and several thermosetting resins.

The original must be consulted for the details but two general conclusions were: the raising of the impact strength of ebonite by polythene or pib, and the reduction of rubber content made possible by improving the mechanical properties by incorporating a resin and then bringing them back again by means of a cheap filler.

Cross-linking Polythene

Translation No. 921 is of more fundamental value. It deals with the kinetics of cross-linking of polythene with benzoyl peroxide.

The decomposition of the peroxide is shown not to be a 'unimolecular reaction' but governed by a second order chain decomposition.

'A kinetic analysis shows that the formation of a cross-link is only an elementary stage in the chain reaction of decomposition of peroxide, but in the cross-linking only the peroxide which decomposes spontaneously can take effective part . . . the portion of peroxide which decomposes otherwise than unimolecularly does not form radicals in the system and is lost without having any effect'.

It is concluded that cross-links between macromolecules of polythene form 'as a result of termination of the radical process of decomposition of the peroxide, as a result of the combining of polymer radicals'. Decomposition of benzoyl peroxide is excited by the benzoic radicals formed by spontaneous decomposition, a second order process. Primary radicals form polymer radicals which not only combine with them but also among themselves. The exact mechanism varies with the temperature.

Russian Building

The latest *Soviet Plastics*, which is the RAPRA translation of *Plasticheskie Massy*, No. 9, 1960 (and published by Rubber and Technical Press, London) is devoted almost entirely to plastics in building. It consists of papers from a conference on this subject, held in March 1960. Other papers from this conference will be published in the next issue of the journal, No. 10, 1960.

The editorial is a splendid piece of plastics sales talk. Traditional building materials are unable 'to meet the demands of modern construction engineering, both as regards quantity and quality'. The use of plastics will 'enable building and finishing work to be mechanized, and reduce both weight and cost'.

Linoleum and tiles from pvc and other polymeric materials will greatly improve the quality of flooring and 'more than halve floor-laying time and costs'. Plastics will 'greatly improve the quality of interior decoration and reduce the laboriousness of the work'. They have a 'very great use in panelling' being only one-tenth of the weight of reinforced concrete panelling.

It is the intention of the Russian seven-year plan to increase production of chipboard, tiles, GRP, linoleum, heat- and sound-insulating cellular plastics, roofing, piping, adhesives, waterproofing materials, and so forth.

These ideas are further expanded in the next article. For instance, it refers to linoleum made from reclaimed rubber, 'mastic flooring based on polyvinyl acetate emulsions with ground sand, talc, etc., added'; imitation wood, stone, or fabric from laminates prepared by hot-pressing several layers of paper dipped in carbamide resins; pvc extrusions; polythene pipes; continuous production of GRP; roofing and waterproofing materials based on glass fibres dipped in plasticized bitumens.

Plasticized Cement

Polyvinyl-acetate-cement mixtures have been studied and a report is given on pp. 6-9. Curves show the effects of various stabilizers and emulsifiers on the stability and ultimate strength. Calcium chloride was found to increase the strength. Data are also given on the effect on strength of polymer : cement ratio and of added plasticizer.

Bonding Asbestos and Cement Panels

Epoxy resins are the best cold-hardening adhesives for bonding asbestos-cement to itself or to wood or cellular plastics.

Another article discusses multi-layer building units for panelling for outer walls, partitions, doors, ceilings, etc., and also deals with window frames. For outer walls, a three-layer is considered in some detail. Partitions are given special attention because 'a characteristic of future building will probably be the "free" planning of apartments, *i.e.* the use of movable partitions'.

The use of plastics will simplify and cheapen doors. Two Russian production processes are now being developed for window frames; one is a hollow section extruded from polystyrene, the other is a GRP product. One of the aims is to reduce the consumption of wood and the Moscow Building Materials Laboratory has developed 'a method of making window and door frames from synthetic resins and wood shavings or particles'. The process is described in detail on pp. 28-33.

A description is given of the mould-casting of architectural and decorative parts using a variety of materials, some of which are polymerized during moulding.

Cementless Concrete

Among the many other items of interest in this issue of *Soviet Plastics* is an account on p. 65 of experiments with 'FA monomer', furfural acetone, which with fillers like clay and a suitable hardener will set at ordinary temperatures. Physical properties can be further improved with other polymers.

CHARLES JENNINGS

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MEN *and* MATTERS

A Review of People and Events

by Peter Richards

RECENTLY I described the steps to success of an Englishman, Bill Holyoak, who joined Dunlop as a tyre builder and has now been appointed works manager of the Fort Dunlop tyre plant. This week a similar success story comes from America.

R. V. Thomas, the new president of Goodyear International Corp, has the right birth certificate for a career in rubber — he was born in Akron. After starting at the bottom of the ladder he became tyre division superintendent of Goodyear-Luxembourg in 1950. Steps upwards were then rapid: 1952 assistant plant manager, Los Angeles, 1955 plant manager, 1957 assistant to the executive vice-president of production, 1958 vice-president of Goodyear International.

The previous president of Goodyear International, F. T. Magennis, had 44 years' service to his credit when he retired. He joined the company in 1917, serving continuously in Central and South America until 1941.

No Complaints

'Why do you buy a foreign car?' people were recently asked in one television interview.

'You know it's right when you buy it. The number of small things that go wrong with a new British car . . .' was one answer which came up time and again.

However, there is one part of one British car that has caused *no* complaints.

Since the first Morris Minor was introduced in 1948, the rubber bellows used in the rack and pinion steering system — one of the outstanding features of British light cars — have been moulded from neoprene. The steering rack itself is lubricated by oil within the bellows which, in addition to giving protection, act as pumps for the lubricant which travels from one bellow to another along the inside of the rack housing as the wheels turn to right or left.

The bellows material must resist temperatures down to −40°F. while remaining flexible and not cracking. At the other extreme it must withstand temperatures as high as 150°F.

More than a million and a quarter Minors have been produced — but, I am told, there has not been a single case of complaint against the bellows material.

Stamp of Approval

That very humble piece of office equipment, the rubber stamp, has now been joined by plastics.

Usually the inked pad is made of a fibrous material, but now Caribonum Ltd. has produced a virtually everlasting pad from a porous pvc copolymer.

Tests have been carried out (but not by hand, I'm sure) to show that the pad survives 80,000 stampings. The ink is contained in a plastics sponge inside the pad and the interior of the case is channelled to enable the ink to flow in all directions and so be uniformly absorbed.

The material, Vyon, is made by the Dagenham firm, Porous Plastics Ltd. Experiments have proved so successful that Caribonum has placed an order worth over £10,000 for the material.

Dental Plate or Gears

Undiscovered uses for plastics may result from a new measuring device which is giving scientists a better understanding of the way different plastics break upon extreme impact.

An 'autographic impact tester' developed by W. E. Wolstenholme, United States Rubber Co., scientist, determines whether a plastics or metal breaks instantaneously or tears or draws more slowly. Mr Wolstenholme described his development at a symposium on high speed testing.

Conventional testing machines measure only the total breaking energy of a plastics sample, Mr Wolstenholme explained. The autographic tester, however, takes a photograph which shows how the sample responds to the striking blow. It records the force as the plastic successively bends, yields and breaks, all in a fraction of a second.

'Since many modern plastics do not shatter under an impact blow', said Mr Wolstenholme, 'it is important to understand exactly how they react when maximum forces are applied against them. The new tester is giving us more complete data than we have had in the past, and has already changed some of our theories on the mechanical behaviour of thermoplastics. By telling us more about the impact properties of plastics and metals, the machine can help us classify them properly for more useful applications in the future'.

He pointed out that a dental plate or football helmet must be made of a material that yields slowly and easily. Plastics pipe and gears, however, need a high strength with a minimum of distortion.

Safe But Not Soft

Seen on the stands at the International Factory Equipment Exhibition, which closes today: a new crepe-seal attachment for multi-wall polythene sacks

Soon the white Christmas — perhaps. Certainly soon the UK tyre containing Diene. Both are in this picture from America. The tyre is a new Town and Country from Firestone; a special feature besides the Diene (which gives improved traction on ice and snow) is the narrow white wall treatment

. . . an unusually flexible zig-zag overhead conveyor . . . demonstrations of a counter which detects and sizes particles in suspension by means of their electrical resistance.

Comfort is an essential ingredient of safety. It is no use supplying a man with protective clothing if it is as awkward as an old suit of armour. I spotted a combined safety harness and overall at the exhibition which

permits perfect freedom of movement for the wearer and can pull him up in a safe sitting position if he slips. The harness, made from grey nylon belting with a red inner core, is constructed and attached to the overall in such a way that the wearer automatically steps into it when putting on his boiler suit.

This is virtually invisible to the outside world — an advantage as some British workmen tend to think that the wearing of safety devices is 'soft'. This particular equipment — made by Barrow, Hepburn and Gale — is ideal for window-cleaners, amongst whom the accident rate is very high.

Another BHG product at the exhibition is pictured here — the Pakwa lightweight safety belt. The workman is 500ft. up on the Forth Road Bridge.

Flying Visit

C. H. B. Dow, general manager, production, and P. S. Reid, the commercial manager of Emerson Walker Ltd., Gateshead — specialists in big blow moulding machine tool manufacture — flew to Germany recently to investigate new ideas in special machinery, plastics and other developments in connexion with blow moulding.

Polly Ester Says . . .

'Chafer strip — impatient night club act'

THE LEGAL ANGLE

Falling Damages

By a Barrister

'The Brockhouse Group has transferred the manufacture of its injection moulding machines from Wolverhampton to Manchester'. — RPW, October 7 1961.

Whether you are transferring your plant from place to place or — more likely — moving your products from factory to customer, you will doubtless employ driver, labourers, porters or loaders to keep the goods on the move. The question as to what happens when one of these men falls from a loading bank to the ground, injuring himself in the process, was considered by Mr Justice Elwes, in a High Court case, in October this year.

The facts as the Judge found them were that late one evening in 1959, a Mr Matthews was loading cartons from a loading platform on to a lorry. The lorry was backed up to the platform, flush with it, but with one side extending beyond the corner of the platform. Some 6ft. of lorry, then, was immediately opposite the bank. The remaining 2ft. were opposite space.

Mr Matthews proceeded to carry some boxes on to the lorry when a fellow workman came out in the opposite direction. Mr Matthews stepped to one side and slightly to the rear, to let his colleague pass — and unfortunately, stepped back into space. If he had been on the part opposite the loading bank, all would have been well. But he was not. The result? He fell, hit his head and — two and a half years after the accident — was still suffering from severe reactive depression which rendered his life an utter misery.

There were two questions before the Court. First, were the employers liable for the accident — and if so, was there any degree of contributory negligence on the part of their employee? And second, what was the proper quantum of damages? How much should the employee recover?

As to liability, the Judge had to decide, in essence, whether the system of work had been so organized so as not to expose the employees in general and Mr Matthews in particular, to unnecessary risk. 'This was a perfectly ordinary case', argued counsel for the defendants, 'where, had the employee been looking where he was going, he would have suffered no injury. And as he had 4ft. of clear space to work from, and knew perfectly well that the lorry was sticking out past the end of the loading platform, he brought about his own downfall'.

'I cannot accept that contention', said the Judge. 'Bearing in mind the particular circumstances of the case, I think that the employers did expose their employee to unnecessary risk. There were a number of men working in a confined space, late at night. They were carrying parcels in their arms and I think that an employer who applied his mind to the problem should have realized that there was a danger of someone falling from the end of the lorry. And this was particularly true where the job was being done in a hurry'.

Nor did the Judge think it right to apportion any of the blame to Mr Matthews. He regarded the man's stepping backwards as an instinctive and natural reaction in the circumstances, and not one which could be regarded as careless.

The result? The Judge awarded Mr Matthews over £2,600 in damages. The moral? When you load lorries, make certain that they are properly backed up to the loading platform, along their full length. If you do not, you may well be exposing your men to unnecessary risk, and if they fall and suffer damage, you may have to pay. And even if your insurance company bears the loss the first time, we cannot guarantee that your premium will stay the same afterwards.

PLASTICS MACHINERY DEVELOPMENTS

Injection Moulding Polyesters

NEW GEORG SEIDL MACHINE INCREASES SCOPE

By JOHN SHEARING

POLYESTER dough moulding compounds are a valuable extension of the polyester range of products. Unfortunately their use has been restricted to some extent because of the difficulty of injection moulding them. Compression moulding has been actively carried out but this relatively slow technique obviously retards development.

The injection moulding of polyester dough moulding compounds is now a reality. After considerable development work, Maschinenfabrik Georg Seidl KG, whose British agents are C. and A. Simms (Engineers) Ltd., of Maidstone, has produced a special injection moulding machine which enables the process to be carried out. It has been demonstrated as a mass production process by the use of Rockite DMC. The resultant products have all the normal characteristics of compression moulding materials including high strength and good finish.

The problem with the injection moulding of polyesters is the same as with any other thermosetting material. If considerable care is not taken, setting-up will take place somewhere in the machine before the moulding has been completed. The Seidl machines overcome this difficulty in three ways. They employ a special plunger, two injection cylinders and a number of stations on a revolving table into which the compound is injected. All these features contribute towards a very interesting and valuable development.

The Injection Unit

In many ways the injection unit has the features of a standard machine. It has an in-line plunger operated hydraulically, an injection cylinder and a spraying nozzle. The injection time is variable and ranges from 5-60sec., depending on the type of material and the moulding size. The injection pressure is variable with a maximum of 900kg. per sq./cm.

The main difference between this machine and others is the revolving injection cylinder. After a shot has been injected it revolves through an angle of 180°, bringing a new cylinder in line with the plunger. The empty cylinder contains a steel tube which is now removed and refilled with the plastics compound. It is replaced in the cylinder and next time a revolution takes place this cylinder is brought in line with the plunger once more. The shot quantity varies from 10 to 500gm.

It is obvious with this arrangement that there is no chance of stagnant material remaining in the cylinders.

Revolving Table

The problem with any material which has to be cured is the wasted machine time during the vulcanization process. This, of course, is one of the principal difficulties with an injection machine which works on a rapid cycle whereas compression moulding works on a relatively slow cycle.

There is only one way of resolving this conflict of requirements. This is to remove the mould from the injection nozzle once the injection process has taken place. Seidl has employed this technique by the use of a turntable on which are situated a number of moulds. Actually it is much more than this. Each mould is virtually contained in a small hydraulic press with a four-pillar support. The locking pressures vary according to the size of the machine, ranging from 150 tons up to 250 tons.

With any machine a four or five form or mould holder can be mounted on the revolving table. Injection is made into the first mould which then moves immediately on, its place being taken by an empty mould. While the table is revolving, the moulding is curing and the mould is opened and the moulding extracted before the station once more approaches the injection point.

Other Details

Although reference has been made to polyester resins, the new injection machine can also be used with other thermosetting materials. In particular, it has been used with natural and synthetic rubbers, including silicone rubber. In the case of the dough moulding compound, an interesting point concerns the fibre length of the glass. Usually the average length is between 6 and 24mm. but for injection moulding the lower value is to be preferred.

The electrical control equipment is installed in a separate console. Separate switches are available if required to perform each operation individually but overall timing can be obtained if required. The heating of the moulds is regulated thermostatically with an error of only ±1%.

Up till now the standard range of machines has included four sizes. These are SPA 4B (locking pressure 220 tons), SPA 4B (locking pressure 280 tons), SPA 5 (locking pressure 150 tons) and SPA 5B (locking pressure 250 tons). A new model is now being produced, SPA 6B, which has six stations and thus greatly increases the scope of the machine.

The G. Seidl SPA 5 special injection-moulding machine enables polyester dough-moulding compounds and other thermosetting materials to be injection moulded

Aspects of Factice

MANUFACTURE: USE IN NATURAL AND SYNTHETICS

THE manufacture and testing of factice, and the use of the material in natural and synthetic rubbers formed the basis of three lectures in a recent course on modern factices at Newton Heath Technical College, Manchester.

J. H. Carrington delivered the lecture on manufacture and testing.

In a review of the literature of the past 60 years, the author dealt generally with the manufacture of dark factice (glyceride oils reacted with sulphur) and of white factice (glyceride oils reacted with sulphur chloride). The types of glyceride oil (vegetable, fish, marine animal), which had been suggested for use were indicated. Modification of the dark factice formulation with mineral oils to achieve economy and with bitumen to achieve good electrical properties were pointed out. The dark factice reaction could be modified by the use of accelerators; lighter coloured products resulting. White factice could be subjected to thermal treatment after manufacture, so that it no longer retarded cure. It was possible to produce dispersions of both dark and white factice for use in latex compounding.

In dealing with analytical methods, the author's paper from the *Transactions of The Institution of the Rubber Industry*, 1935, **11**; 302, was taken as a basis for amplification. The rubber trade still regarded acetone extract and free sulphur as the criteria upon which to base evaluation and control of factice. It was clear that the exact nature of the acetone extract and of the various 'free' sulphurs determined by different analytical methods left room for elucidation. More important was the behaviour of a factice in compounds based on natural or synthetic rubbers; compounding and processing tests were a surer guide of quality.

Factice in Natural

The types of dark and white factice available to rubber compounders were dealt with in the lecture on factice in natural given by J. Donnelly.

The advantages attendant on the use of dark factice were examined in relation to the effects obtained during mixing and processing operations. It was demonstrated that notable power economy resulted during mixing with the use of as little as 6.5 volumes of No. 2 dark factice.

Compounds containing high filler loadings were shown to have reduced tendency for 'bagging' during open mill mixing and reduced tendency for 'crumbing' during mixing in an internal mixer. The useful properties of factice during subsequent processing were illustrated in connexion with thin-walled extruded tubing and triangular extruded tubing.

The lecturer then went on to describe the advantages of the application of factice in calendered sheet and sponge rubber articles where dimensional stability of the uncured compound and control of cold cure was important.

Economic Aspects

The application of white factice was restricted mainly to cold cure proofed goods and the manufacture of erasers. Finally, the economic aspects of factice addition were considered and the subject of volume costing of rubber articles was examined in some detail.

The well-known processing advantages of factice are conferred on synthetics as they are on natural rubber; nerve is controlled, open mill mixing is speeded, calendering and extruding are facilitated, and the non-thermoplastic structure of factice provides support in open steam cures. This was stated by B. Pickup in the lecture on factice in synthetics. The lecturer presented laboratory test data which demonstrated these processing advantages in neoprene, nitrile, butyl and Hypalon synthetic rubbers. Significant improvements in processing were obtained by addition of as little as five parts of factice, and such additions had little or no significant effect on vulcanizate properties. Mr Pickup pointed out that larger additions could cause a slight lowering of tensile strength, modulus and hardness, under some circumstances.

In neoprene and nitrile rubbers factice could influence and control swelling in oils and petrol, he declared. Oil-resistant factice was particularly useful since it controlled swell and diminished extraction by the swelling medium. Third grade dark factices were also used to reduce swelling, but they were less effective than oil-resisting grades in reducing extraction.

The lecturer said that the processing advantages of factice could be utilized in butyl without affecting rate of cure or the essential characteristic properties of butyl vulcanizates. Similarly, said Mr Pickup, the use of factice in Hypalon gave processing advantages without detriment to the performance of vulcanizates.

L. L. Roe presided at the lecture.

The three lectures were part of a series of six on factice given at Newton Heath Technical College. The opening two lectures were reported in RPW November 4, 753.

PI News

Foambacks in South Wales

IN latex foam, there is little recent technical development to record. Increasing use is being made of synthetic latices but the main factor appears to be now an economic one.

It is in the field of the urethane foams that most advances are being made. Polyether - based urethane foams are overtaking the polyester-based in output, being used for upholstery; the 'one-shot' process is gradually superseding the prepolymer method.

These developments were discussed in Cardiff on November 8, when S. B. Cant, of Lintafoam Ltd., gave a talk, which opened an excellent question-and-answer session, on 'New Developments in Flexible Foams', to the South Wales and Monmouthshire Section of the Plastics Institute.

Mr Cant described some of the fabricating machines used, such as profiling and veneer-cutting knives, to obtain special, contoured shapes, and continuous thin sheets. An outstanding field which still has much scope for development is the reduction of waste and off-cuts in the urethane fabricating and finishing processes, which may represent as much as 25% and has only a low value when sold for loose fillings or for cohering into blocks with an adhesive.

Another field ripe for developments is the design of an intermittent foamer for urethanes. Some such machines, which mix, eject, and clean the mixing chamber, are already available and can be teamed-up with a mould-carrying conveyor.

Mr Cant exhibited several new types of foam products, chiefly urethane. They include gaskets made in continuous lengths, crash pads and facia panels, door armrests with an outer rotocast pvc skin and metal inserts for attachment. He described other new products such as complete, single-unit upholstered seats for tractors and coaches, moulded packagings reputed to be more efficient as shock absorbers than rubberized hair, and industrial air filters.

He came then to one of the main recent developments, the rapidly

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SYNTHETIC ADHESIVES

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is expected that this state of affairs will continue for some time. Table 2 briefly indicates the applications and the types of bonds obtainable from some of the adhesives previously described.

TABLE 2

Adherend (Primary)	*Adherend (Secondary)*	*Adhesive*	*Quality of bond*
Wood	Wood	Phenol, urea and melamine formaldehyde	Good
Wood	Metal	Epoxide or resorcinol formaldehyde	Good
Metal	Metal	Epoxide	Good
Glass	Metal	Cellulose nitrate, silicones and cyanoacrylate	Fair
Plastics	Leather	Liquid polyamides/epoxides	Good
Ceramics	Ceramics	Liquid polyamides/epoxides	Good
Glass	Glass	Polyvinyl butyral and epoxides	Good
Leather	Leather	Polyvinyl acetate and rubber latex	Good
Paper	Paper	Polyvinyl acetate	Good
PTFE	PTFE	Etched surface and epoxide adhesive	Good
Polythene	Polythene	Treated surface, epoxide or pressure-sensitive silicone	Fair
Polymethyl-methacrylate	Polymethyl-methacrylate	Solution of polymer in monomer or in solvent such as chloroform	Fair
Polyester film	Polyester film	Pressure-sensitive silicone	Fair
Polystyrene	Polystyrene	Cement prepared by dissolving polymer in styrene monomer	Fair
Rubber	Rubber	Dependant on type of rubber to be bonded, chlorinated rubber may be used.	Good
Rubber	Metal	Cyclized rubber	Good
PVC	PVC	Polysulphides	Fair

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AGEING SYMPOSIUM AT WELWYN

Continued from page 835

Creep and Fatigue

The last paper, delivered by Dr A. G. Thomas, was on factors influencing creep and fatigue. He described the creep, stress relaxation and hysteresis behaviour of vulcanized rubbers up to moderate extensions, before crystallization occurred.

Two types of relaxation process occurred. The first, dominant at short periods, was linear with the logarithm of the time; the second, important at longer periods, was approximately linear with time. The latter was associated with chemical effects, the former with the relaxation of physical (secondary) forces and was the aspect which Dr Thomas discussed. Measurements showed that the rate of stress relaxation was independent of strain. Hysteresis under cyclic loading could be related to this rate theoretically, with fair agreement with experiment. He showed that creep under constant load was related to the rate of stress relaxation and the relevant stress-strain relation. He then went on to describe the cut growth behaviour of natural rubber vulcanizates. Repeated stressing was necessary to cause significant cut growth, and the behaviour was expressed in terms of the 'tearing energy' concept. Fatigue failure was shown to be determined by the growth of small flaws present initially in the specimen, and thus was a particular aspect of cut growth.

Measurements in a vacuum showed reductions in the rate of cut growth and corresponding increases in fatigue life. The presence of antioxidants also produced a similar although less pronounced effect.

FOAMBACKS IN SOUTH WALES

Continued from page 842

growing uses of the urethane foams in the several fields of heat insulation and particularly the success of the so-called 'foambacks'. In this use, the urethane is stuck, by an adhesive or by superficial heat-melting, to a fabric, so producing a material of such high heat-insulating qualities that it can be used for making 'warm' winter coats at only a fraction of the weight of conventional cloths.

It was this aspect of the subject, together with the many samples of foam-backed fabrics and made-up garments which were exhibited that attracted the most questions and discussion after the lecture.

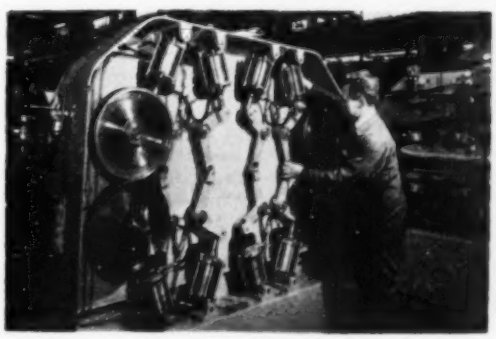
Not only is foam-backing altering the old notion that warm clothes must be heavy but it is giving to certain fabrics a stability and drape which have opened wide, new avenues of use. Despite the porous structure of the foam, the water absorption is low because the urethane itself is hydrophobic; the cellules are intercommunicating and the foamback is therefore quite permeable so that there is no moisture condensation as with impermeable garments. Resistance to chemical cleaning is excellent, and much work has been and is being done on increasing the flame resistance, though backing of the foam by a fabric considerably reduces the flammability.

Rigid urethanes are finding heat-insulating applications in refrigeration and buoyancy uses like boat building, because they simplify construction by being foamed *in situ*.

A vote of thanks, proposed by R. Kinnersley-Haddock, was passed with acclamation. The chair was taken by E. H. Vokes.

To Market

Dr Arifin Harahap, the Indonesian Minister of Trade, during a short visit to London last week, visited the rubber market.



Caterpillar haul-off machines in the assembly shop at Fawcett Preston and Co. Each haul-off is driven through a four-speed gearbox and can exert a pull of 5,000lb. on cables up to 5in. in diameter. Two caterpillar tracks of chain-mounted rubber treads, synchronized through helical gears, grip the cable by mean of two linked sets of air-operated shoes

Plantation Newsletter

HARSH WORDS FROM THE MINISTER

by our Malayan Correspondent

FROM KUALA LUMPUR

HARSH words seldom come to the lips of Malaya's Minister of Commerce and Industry, Inche Mohamed Khir Johari, but the recent US and UK stockpile selling decisions made him really angry and his accusation against America of 'economic aggression' brought a swift reply from Washington. The American reply, however, was not sufficient to allay the very grave dismay felt here as far as Malaya's economic future and planning are concerned.*

It has been observed that the Minister might well have included Whitehall in his forthright comments, for rubber stockpile sales in Britain as well as in the USA are already having a serious effect on Malaya's economy. Malaya has budgeted its entire second five-year plan (1961-65) on a rubber price of 80 cents (Malayan) a lb., and the plan falls to pieces if the price starts sliding.

Move Destructive

Some rubber leaders described the move as destructive of the stability and economic well-being of the natural rubber producing countries — and Malaya is the world's leader.

Every movement of five cents in the rubber price means $20m. a year to the Malayan Government's revenue. For some time there have been discussions between Malaya and America on the future of the American stockpile and Malaya maintained that it adopted a realistic attitude in view of the growing production of stereo-regular synthetic rubbers.

In fact, Malaya saw no objection to sales at a maximum rate of 5,000 tons a month at a price between 32 cents and 28 cents (US) a lb., and unlimited sales at prices above 32 cents a lb. But Malaya could not agree that sales should continue at this rate at prices below 28 cents a lb. What Malaya proposed as a safeguard was that sales at prices below 28 cents should be limited to 2,000 tons a month, and what has knocked this country for six is that the American GSA has refused to recognize a 'floor'.

Malaya has already been in touch with other producing countries — Liberia, Indonesia, Ceylon, Thailand, Vietnam and Nigeria, and it is believed here that collectively they might be able to make their voices heard.

In fact, Malaya minces no words when she says that she will hold America responsible if its five-year plan is jeopardized. 'No amount of eloquent speeches from American leaders will do us any good when they have broken our rice bowl. We will make use of every opportunity to us to press our case', said the Minister.

As the *Malaya Mail* commented: 'Malaya's call in the past is still the same today . . . Trade not aid. She has seen, without any feelings of envy, fantastic sums of money poured into other Asian countries, South Vietnam, South Korea, Formosa, to mention but three.

'All Malaya asks for — and she does this as a self-reliant and firmly-established independent nation — is for the opportunity to sell her exports and to enjoy such trading conditions as will enable her to plan with some sense of security for the future economic and political stability of the country'.

The Rubber Producers' Council, the Malayan Estate Owners' Association, the Rubber Growers' Association, the United Planting Association of Malaya, the Council of Malayan Smallholders, and the National Union of Plantation Workers have all registered their protests.

Indeed, one of the most respected names in rubber has described the joint release of 6,000 tons of rubber a month on to the market at this time, as the West's greatest political blunder in Asia in many years.

Malaya has always been suspicious of commodity stockpiles and primary producers can feel safe only when they are specifically labelled 'for emergency use only'.

**Under the USA's revised selling structure, rubber can be sold below 32 cents a lb. up to a maximum of 5,000 tons a month. The UK has recently made a similar decision. The full text of the USA announcement was published in last week's issue (RPW, November 11, page 788).*

Rubber Statistics

WORLD POSITION TO JULY 1961

THE following advance information on the world rubber situation has been issued by the Secretariat of the International Rubber Study Group (in long tons):

NATURAL RUBBER

	July	January/July
Production ..	192,500	1,162,500
Deliveries from Stockpiles[1] ..	3,000	17,000
Consumption[2] ..	157,500	1,167,500

STOCKS END PERIOD

In producing areas	280,000
In consuming areas	215,000
Afloat	217,500
	712,500

[1]Deliveries from the government stockpiles of the US and the UK.

[2]Including estimated imports into the Soviet Union and China as follows: Soviet Union: July, 25,250; January/July, 184,750; China; July, 2,000; January/July, 34,000.

SYNTHETIC RUBBER

	July	January/July
Production ..	155,000	1,067,500
Consumption ..	140,000	1,047,500

STOCKS END PERIOD .. 372,500

Reported exports of rubber from Indonesia during July 1961 amounted to 52,072 long tons of which 21,858 long tons were reported as being of estate origin.

West Germany

West Germany's rubber tyre production rose again after the holiday period to reach a total of 21,486 tons (provisional) during September compared with 19,310 tons (revised) in August and 20,778 tons in September of last year, according to the Federal Bureau of Statistics.

Production in the first nine months of this year totalled 177,715 tons (provisional) against 172,332 tons in the corresponding period of last year, the Bureau added.

Output of other hard and soft rubber goods during September was 23,372 tons (provisional) against 23,066 tons (revised) in August and 23,924 tons in September of last year. In the first nine months of this year, it amounted to 209,771 tons (provisional) against 210,345 tons in the corresponding period of last year.

Imports of natural rubber and rubber sole crepe during August totalled 9,591 tons (provisional), including 6,049 tons from Malaya. In the first eight months of this year, imports totalled 77,141 tons.

Imports of synthetic rubber in August totalled 3,487 tons (provisional) including 1,452 tons from the USA, 750 tons from Canada, 395 tons from the Netherlands and 303 tons from France. In the first eight months of this year they totalled 32,113 tons.

Malaya

Imports of rubber into Singapore and Malaya during October, on the basis of final documents received, amounted to 40,706 tons (actual arrivals 37,073 tons), according to preliminary figures issued by the chief statistician on November 13.

This compares with imports of 39,210 tons in September, when 46,164 tons were actually received.

The October figures include 22,078 tons imported on provisional permits in previous months for which final documents have been received and exclude approximately 18,445 tons imported during the month for which final documents have not yet been received.

COMPANY MEETING

Harrisons and Crosfield Ltd.

RUBBER RESULTS AND PROSPECTS

Sir Leonard C. Paton's Survey

THE annual general meeting of Harrisons and Crosfield Ltd. will be held on December 6 in London.

The following are extracts from the circulated statement of the chairman, Sir Leonard C. Paton, CBE, MC.

Group earnings for the year have just not reached 1960's record figures. Trading in the Eastern countries was again buoyant, but Australia, Canada and America, for varying reasons, were all well below last year, both in turnover and profit. Results from UK operations were higher. In total, the Group short-fall on 1960 was slight and, when tax is deducted and the amount brought forward included, the balance available for allocation is ahead.

Group profit for the year was £1,618,373 from which taxation of £911,281 has to be deducted.

Last year the final dividend paid on the deferred ordinary stock was 9¼% with a bonus of 2½%. This year the directors recommend a final dividend of 12%, repeating last year's total distribution of 15%, but as a straight dividend without bonus. The directors have refrained from proposing an increase in the distribution on this occasion in deference to the Chancellor's appeal.

Capital Reserve in the consolidated balance sheet shows a reduction of £195,000, mainly due to writing off the goodwill element in new investments reported in 'Group Operations'. Other reserves increased from £3,776,260 to £4,166,141 during the year. Liquidity remains high, a cardinal point in our trading policy.

Income from trade investments at £337,286 shows an increase of £103,000. Their value continues in excess of the figures in the balance sheet.

Group Operations

Group turnover, exclusive of sales of the produce of the Plantation Companies whom we represent, was over £71m., compared with £79m. last year. The reduction was almost equally split between the lower price of rubber handled by our own dealing departments and the fall in business in Canada.

Activity remained high. The merger of eight plantation companies under our agency in Sumatra has been carried a step further. Another eight companies have, since last reported, come under the wing of the new holding company, London Sumatra Plantations Ltd. This now forms a strong group well equipped for efficient and progressive operation. Total planted area has risen to 120,000 acres, mainly rubber and oil palms, situated for the most part in North Sumatra, but also including properties in Java and Celebes.

Expansion in the UK continued.

Profits of Wilkinson Rubber Linatex Ltd. capped previous records.

Sand dewaterers and classifiers have been further developed, and several are under construction designed to supply high grade sand for atomic power stations, bridges and new motorways. Sand plants, pumps, ball mills and valves remain the chief products of the Camberley factory and have resulted in full production and a full order book.

Sales of Linatex pumps to Germany and Italy in particular have expanded as the success of Linatex linings in combating abrasive wear becomes widely known. These pumps are now standard on many tin mines: an important Italian company has incorporated a number in a chemical plant destined for Russia.

After reviewing the Group's activities in the individual countries in which it operates, the statement continues:

Rubber

A lengthy analysis of the rubber industry seems rather redundant, as no other primary product is more generous in providing day-to-day statistics and general information. Prices in 1961, up to mid-October, are down compared with the 12 months of 1960. The average for No. 1 RSS spot London was 25¼d. per lb., compared with the 1960 average of 32½d. Larger stocks in Malaya and a possibility of further stockpile releases have moved prices within narrower limits down to lower levels. This has strengthened the competitive position of natural rubber in 1961.

Consumption. — In the USA the car industry has had special difficulties. Stocks of vehicles accumulated following a hard winter. Consequently, production, notwithstanding good reception of the 1962 models, is unlikely to be better than an average year. In Europe, the industry is only now emerging from an export crisis, which Germany alone has partly avoided. The UK, previously exporting some 50% of output, has proved vulnerable to slackening demand from abroad and the credit squeeze at home. Consumption of natural rubber has thus fallen, both in the USA and West Europe. This has been partly offset by increased Russian and East European purchases. China, with famine at the door, has tended to divert imports towards foodstuffs.

World Production. — Current estimates indicate the possibility of a further surplus of natural rubber in 1961, although perhaps only half the size of 1960. This is partly due to smaller disposals from stockpile. Total 1961 consumption of natural rubber may reach 2m. tons, against supply of about 2,065,000 tons (including approximately 30,000 tons from stockpile).

Prospects. — Prospects for 1962 are difficult to assess. There are renewed fears of inflation: recovery in the USA is being induced by Government spending: the rate of growth in the Common Market countries shows signs of slackening under pressure from increasing costs and labour shortages: expansion in the UK depends on the success of the recent measures undertaken to restore competitive strength. Britain's entry into the Common Market, still under study, is at present an unpredictable factor.

It is good that the rubber industry is meeting the future with great energy. Basic research is being pressed as never before, led by the Malayan Rubber Fund Board, backed by a strong co-ordinating advisory committee in London. It is noteworthy that, in the main, synthetics, as they emerge, claim that they approach or match one or other of the properties of natural rubber. The effort to produce as nearly as possible natural rubber is surely acknowledgment that it remains supreme in its own field.

The second great factor is the control over costs which is being won by the different replanting programmes. The introduction of high-yielding stocks over a vast acreage of old rubber, both on estates and smallholdings, has been accelerated in recent years under the incentive of Government replanting schemes in different Eastern countries. There is good hope that the Malayan scheme, which terminates at the end of next year, will be extended for a further period. Continuance will clearly be advantageous to the future revenues of the Governments concerned as well as to the earnings of all classes of producers.

The finest natural rubber that research and skilled husbandry can provide, and the most stable economic price that can be attained, will assure to natural rubber its proper share in the steadily expanding industrial production of the world.

Prospects

Last December, at the annual general meeting, rather higher profits were reported than at the same date the year before. Nevertheless, the final figure at June 30 has failed, although narrowly, to reach the previous 12 months. This shows the unwisdom of forecasting.

What can be said is that, while pressing vigorously our general trading, we are increasingly buttressing the plantation and trading sections of the business with industrial activities, where the same basic qualities are needed for success.

Rubber Markets

LONDON

After fluctuating narrowly, UK rubber prices finished the week ending November 15 virtually unchanged on balance. The bulk of the movement stemmed from likewise trends at origin, although at midweek traders thought that the firmer Singapore tone, due to increased tension over Laos coupled with rumours of a sharp reduction in October imports, had been over emphasized. Initially, business in both landed and physicals was largely routine, and consequently restricted to covering. However, fairly good demand for No. 1 RSS towards the end of the period was offset by some Continental selling, said traders. They added that a few fresh orders were latterly creeping into the market, thereby keeping values comparatively steady. Off-grade trading was somewhat specialized, being mainly limited to nearby shipments.

Latest prices are as follows:

No. 1 RSS Spot: 22¼d.-22½d.

Settlement House:
December 22¾d.-22⅞d.
January 22¼d.-22⅜d.
February 22⅜d.-23d.
March 22⅜d.-23d.
January/March 22⅜d.-23d.
April/June 23d.-23¼d.
July/September 23⅛d.-23⅜d.
October/December 23⅛d.-23¼d.

No. 1 RSS cif basis ports:
November 21⅞d.-22⅛d.
December 22⅛d.-22⅜d.

Godown:
December 74⅛ buyers (Straits cents).

LATEX

Centrifuged 60% latex per gallon in drums, seller, December/January, 13s. 3d. cif European ports. Spot, seller, 13s. 9d. Bulk, seller, d.w. 13s. 2d. Normal, seller, December/January, 10s. 5d.

AMSTERDAM

The Amsterdam rubber market ruled as under on November 13:

	Guilders per kilo	
No. 1 RMA	Nov. 13	Previous
November	2.16	2.15
December	2.16	2.15
October/December ..	2.16	2.15
January	2.16	2.15
February	2.16	2.15
March	2.16	2.15

Sales: Nil. Tendency: Quiet.

BANGKOK

The price of No. 1 RSS at Bangkok on November 13 was 24.75 (24.75) US cents per lb.

CEYLON

The price of No. 1 RSS at Colombo on November 13 was 87⅛ (86) Ceylon cents der lb.

NEW YORK

The New York rubber market ruled as under on November 13:

DEALERS' PRICES

	US cents per lb., ex-dock	
	Nov. 13	Previous
No. 1 RSS, Nov. ..	27⅛b–27⅛a	27⅛a
Dec. ..	27⅛b–27⅜a	27⅛a
No. 2 RSS, Nov. ..	27⅛b–27⅜a	27⅛a
Dec. ..	27b –27⅛a	27a
No. 3 RSS, Nov. ..	27b –27⅛a	27a
Dec. ..	26⅞b–27⅛a	26⅞a
No. 1 RSS, Spot ..	27⅜n	27⅜n
No. 3 amber blanket crepe, Nov. ..	25⅛n	25⅜n

FUTURES—REX CONTRACT

	Nov. 13	Prev. Close
Jan. ..	27.31b–27.55a	26.95b–27.10a
March ..	27.31t	27.05t
May ..	27.25b–27.30a	26.90b–27.00a
July ..	27.25b–27.30a	26.80b–27.00a
Sept. ..	27.20b–27.30a	26.75b–27.00a
Nov. ..	27.20b–27.30a	26.75b–27.00a

Sales: 12. Tendency: Very steady.

Futures were firmer on November 13 on covering following the advance in Singapore. Dealings were light. Physical rubber was very steady but quiet. In the closing stage, futures were very steady.

SINGAPORE

Opening levels were somewhat higher on November 13 on reports of increased tension over Laos, but at the higher levels profit-taking was in evidence and prices eased as buyers' interest subsided. Later in the day, the market steadied on rumours of a sharp reduction in October imports. In the afternoon, the market ruled steady on publication of the October import figures. Better buying developed and the market closed at the day's high. Lower sheets were in selective demand.

	Malayan cents per lb., fob Malayan ports to open ports	
	Nov. 13	Prev. Close
No. 1 RSS, Nov. ..	75¼–75¾	74 –74⅜
Dec. ..	76 –76¼	74⅜–75
No. 2 RSS, Nov. ..	73¾–74¼	72⅜–73¼
No. 3 RSS, Nov. ..	73 –73¼	72 –72¼
No. 4 RSS, Nov. ..	72¼–72⅜	71 –71⅜
No. 5 RSS, Nov. ..	70¾–71¼	69¼–70¼
No. 1 RSS, prompt ..	75 –75½	74 –74½
No. 3 blanket thick re-milled crepe, Nov.	72¼–73¼	71¼–72½
No. 1 fine pale crepe, Nov.	86 –87	85 –86
2x Thin brown crepe, Nov.	70¼–71¼	69¼–70¼

Tendency: Steady, quiet.

DJAKARTA

	Rupiahs per kilo	
	Nov. 13	Previous
Spot, No. 1 Priok ..	41.00b	40.50b
Spot, No. 2 Priok ..	40.00b	39.50b
Spot, No. 3 Priok ..	39.00b	38.50b
Spot, No. 1 fine pale crepe	37.00b	37.00b

Tendency: Steadier.

FBRAM HEARS OF RAILWAY PROGRESS

THE progress of UK railway modernization was described at the annual open meeting of the FBRAM's Transport Committee, which was held at the Cafe Royal, London, on November 9. The meeting was well attended by representatives from the traffic departments of a number of rubber manufacturers and suppliers to the industry.

The guest speaker was A. Granville, assistant freight officer at British Transport Commission Headquarters. In describing modernization progress Mr Granville said that five major schemes for marshalling yards had been completed and more were under way, with the latest electrical devices, such as closed circuit television, electronic equipment for the application of automatic retarders and radio telephones. In the course of time the continuously welded rail system would be installed throughout the country, and all wagons used for general merchandise would be fitted with vacuum brakes.

Mr Granville declared that a large number of the existing one thousand stations accepting parcels would cease to operate and small consignments would only be received by about 200 stations — additional mechanized concentration depots for parcels traffic were planned. There were major schemes in hand for mechanizing many goods stations including conveyor belt systems for the movement of goods between the railway wagon and the cartage vehicle.

In the question period which followed, industry representatives present put a number of pertinent questions to Mr Granville on the competition of road and rail, and on the prospects before the railways if Britain were to enter the Common Market.

Hose Underground

BTR Industries Ltd. has been awarded a contract to supply the National Coal Board with more than 200,000ft. of 2½in. bore plastics fire hose for underground fire prevention purposes.

Industry Intelligence

Owing to pressure on space our regular feature Industry Intelligence has been held over this week. It will be resumed next week.

Lecture for the Young

The IRI Scottish Section Committee proposes to arrange a Young People's Lecture in the Easter 1962 period.

British Standards

Methods of Testing Vulcanized Rubber

Two new methods of test for the determination of rubber-to-metal bond strength are described in the newly-issued part A21 of BS 903.

The first method covers rubber which is assembled to two metal plates, and the other deals with rubber assembled to one metal plate. The publication also gives details of the test piece, apparatus, preparation of test piece, procedure, and method of operating.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 3s.

Low Density Polythene for Moulding and Extrusion

BS 3412, recently issued by the British Standards Institution deals with low density polythene materials for moulding and extrusion.

It is recognized that at the present moment the standard may not cover all the properties thought to be necessary for each application for which polythene of this kind is being used or is suitable. In this case it will therefore be necessary for the user to state his own special requirements in addition to those covered.

The foreword gives advice on the behaviour of the various types of material and specifies basic requirements for nine types of polythene ranging in nominal density from 0.915 to 0.925g/cc and having a nominal melt flow index not exceeding 25.

Requirements are also laid down for physical properties as well as methods of test.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 4s. 6d. each.

Future Events

Institution of the Rubber Industry

Humberside Section. — November 23 at the Yarborough Hotel, New Holland, at 7.45 p.m. Film evening — recent rubber and plastics films.

Manchester Section. — November 27 at the Engineers' Club, Albert Square, Manchester, at 6.45 p.m. 'Safety in Rubber Factories', by H. Jackson, MSc (Leyland and Birmingham Rubber Co. Ltd.).

Plastics Institute

London and District Section. — November 21 at the Borough Polytechnic at 2.30 p.m. Students' lecture.

Midland Section (Reinforced Plastics Group). — November 24 at the James Watt Memorial Institute, Gt. Charles Street, Birmingham 3, at 7 p.m. 'Developments in Curing Systems for Polyester Resins', by J. W. Gwinski, BSc(Econ), LLM, API (Novadel Ltd.).

Western Section. — November 22 at Westinghouse Brake and Signals Co. Ltd., Chippenham, at 7 p.m. Plastics in railways.

NEW COMPANIES

Hilro Plastics Ltd. (703,915). September 22. Capital: £100 in £1 shares. The directors are: Donald S. Hilton, 42 Mendip Crescent, Westcliff-on-Sea, Essex; Harry Buckley, 12 Recreation Avenue, Leigh-on-Sea, Essex. Regd. office: 25 London Road, Southend-on-Sea, Essex.

Allan Rushton Ltd. (703,219). September 14. Capital: £2,500 in £1 shares. To carry on the business of manufacturers and moulders of, and dealers in, plastics and plastics products, polyester resins, etc. The directors are: Anthony C. H. Morgan, Callaly Cottage, Adderbury, Oxon.; Allan F. R. Rushton, 14 Edinburgh Drive, Kidlington, Oxon.; John C. Payne and Jack R. Risbridger. Regd. office: The Old Sawmills, Gatteridge Street, Banbury, Oxon.

Lignin Engineering Co. Ltd. (703,149). September 13. Capital: £100 in £1 shares. To carry on the business of specialists in the design, construction and erection of plant, machinery and spare parts for the manufacture of particle board, and for the moulding of particle/adhesive compounds, and for the surfacing of such products with laminates, veneers, plastics, etc. The directors are: Leonard H. Howard Jones, Rifle Range Farm, Fleet Road, Hartley Wintney, Basingstoke, Hants; John Grindrod, 194 Longlands Road, Sidcup, Kent. Regd. office: 109 Fleet Road, Fleet, Hants.

Foambacks Ltd. (703,078). September 12. Capital: £100 in £1 shares. To carry on the business of manufacturers of, and dealers in, polyurethane and other plastics materials, materials laminated with foam plastics, etc. Henry Blake is the first director. Regd. office: 15 Park Street, Manchester, 15.

Plastmant Ltd. (703,157). September 13. Capital: £100 in £1 shares. To carry on the business of manufacturers of, and dealers in, plastics, modelling and moulding materials, etc. The first directors are to be appointed by the subscribers.

Ajon Machinery and Services Ltd. (703,125). September 13. Capital: £100 in £1 shares. To carry on the business of manufacturers of, and dealers in, plastics, modelling and moulding materials, plastics processing machinery, injection moulding and extrusion machinery, etc. The directors are: Alan D. Horslen and Ena J. Horslen, both of 30 Rogers Lane, Stoke Poges, Slough, Bucks. Regd. office: 35 Essex Street, W.C.2.

Invicta Tyre Service Ltd. (703,641). September 19. Capital: £100 in £1 shares. The directors are: Joseph E. Sattin, 49 Selborne Road, Hove; Joseph O. Sattin, Manor Cottage, Upper Beeding, Sussex; Douglas K. Young and George T. Brawn. Regd. office: 73 Eastern Road, Brighton.

Retreading Equipment Ltd. (703,616). September 19. Capital: £100 in £1 shares. To carry on the business of engineers, etc. The directors are: Peter J. Kent and Mrs Anne A. Kent, both of Old Rectory Cottage, Medstead, Hants. Regd. office: 4 High Street, Alton, Hants.

Ruo Estates Holdings Ltd. (703,529). September 18. Capital: £100 in 5s. shares. To acquire the whole or any part of the issued share capital of The Ruo Estates Ltd., or the whole or any part of the undertaking, property or assets thereof, and to carry on the business of rubber and tea planters, etc. Regd. office: Candlewick House, 116/126 Cannon Street, E.C.4.

Every Woman's Products Ltd. (704,305). September 28. Capital: £100 in £1 shares. To carry on the business of light engineers, plastics moulders, etc. The directors are: Ernest V. Jones, 126 Park Lane, Hornchurch, Essex; Thomas R. Wallington, G5 c/o Palmers Caravan Site, Old Church Road, Romford, Essex. Regd. office: 248 Crow Lane, Romford, Essex.

Latest Wills

Kenneth Fraser Miller, of 11 Marchbank Road, Bieldside, Aberdeenshire, formerly of Park Crescent, Portsoy, Banffshire, retired rubber planter, who died on June 24 1961, left personal estate in England, Scotland and abroad valued at £18,419.

Reginald Maurice Skeet, of 251 Grove End Gardens, N.W.8, late chairman and managing director of Laras (Sumatra) Rubber Estates Ltd., Dashwood House, E.C.2, and chairman or director of several other rubber concerns, who died on April 11 1961, left £9,423 net value.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

Flamingo (806,980). All goods included in Class 17, but not including sheets made of plastics, rubber or synthetic rubber, for use in the manufacture of footwear. Flamingo Foam Ltd., Monsanto House, 10-18 Victoria Street, London, S.W.1. (Class 17; October 4 1961).

Vibrasorb (817,399). Anti-vibration mountings and anti-vibration dampers, all made wholly or principally of rubber or of plastics and included in Class 17. Delaney Gallay Ltd., Vulcan Works, Edgware Road, Cricklewood, London, N.W.2. (Class 17; October 4 1961).

Zerlon (809,885). Thermoplastic synthetic resins comprising polymers and copolymers of vinyl aromatic compounds and copolymers of styrene and of methyl-methacrylate, and being for use in manufactures. The Dow Chemical Co., City of Midland, State of Michigan, U.S.A. Address for service is c/o W. P. Thompson and Co., 12 Church Street, Liverpool 1. (Class 1; September 20 1961).

Chemfast (820,624). Articles included in Class 6 made of common metal. Chemidus Plastics Ltd., Dominion Buildings, South Place, London, E.C.2. (Class 6, September 20 1961).

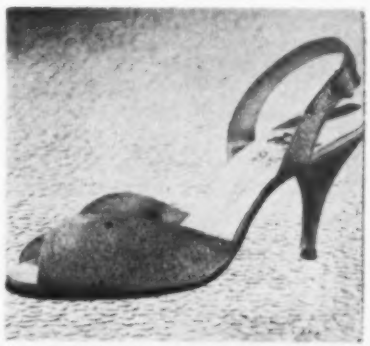
Prova (812,294). Electric insulating materials, rubber bands (not stationery), rubber gloves included in Class 17, rubber hardware and asbestos plates. British Home Stores Ltd., Marylebone House, 129-137 Marylebone Road, London, N.W.1. (Class 17; September 20, 1961).

Scopasol (822,489). Synthetic resins for use in manufactures. Styrene Co-Polymers Ltd., 1 Roebuck Lane, Sale, Manchester. (Class 1; September 27, 1961).

Increases of Capital

Woodward and Co. (Whitefield) Ltd. (334,541), manufacturers of, and dealers in, rubber, etc., Derby Mills, Radcliffe New Road, Whitefield, Manchester. Increased on February 9 1961, by £100 in £1 ordinary shares, beyond the registered capital of £25,000.

Kuala Lumpur - Kepong Amalgamated Ltd. (88,831), formerly Kuala Lumpur Rubber Co. Ltd., 53 Eastcheap, E.C.3. Increased on November 23 1960, by £2,110,360 10s. in 2s. ordinary shares, beyond the registered capital of £2,000,000.



A new design in pvc-coated fabric by Mellowhide Products Ltd. consists of a 'stipple' which gives a metallic sheen. This sample sling-back sandal has been produced in the design by C. Rosen and Sons Ltd., Hull. British Geon Ltd. pvc is used in making the fabric

CLASSIFIED ADVERTISEMENTS

RUBBER AND PLASTICS WEEKLY

APPOINTMENTS VACANT

8d. a word, Minimum 12/- Box 2/-

ASSISTANT latex chemist, preferably with some knowledge of latex foam, required for interesting development work involving natural and synthetic latex. Time allowed for continued studies if required.—Applications to Lintafoam Ltd., P.O. Box 25, High Wycombe, Bucks. (160)

DUE to considerable expansion of sponge department an experienced chemist and a technician are required to assist in development and control. Good welfare schemes and conditions.—Apply stating experience and salary required to Box 171. (171)

DEPUTY chief chemist. A qualified chemist/rubber technologist required in age group 35-45 by company on the South Coast. Experience of plastics technology would be an advantage. The company manufactures a specialised range of products.—Please write, giving details of age, education, experience, salary, etc., Personnel Manager, Fireproof Tanks Ltd., The Airport, Portsmouth. (156)

EXPERIENCED estimator required for rubber company engaged in the manufacture of moulded and extruded rubber products for the car trade. Applicants should be capable of compiling complete estimates from customers' drawings. Age 25 and upwards.—Box 168. (168)

MSL *have been retained to advise on this appointment.*

TECHNICAL DIRECTOR DESIGNATE

Rubber Technology

to assist the Managing Director of the largest independent tyre retreading and rubber to metal bonding company in the Republic of Ireland.

He will be responsible for planning and co-ordinating production in a number of plants and for the general technical supervision of the plant managers. He will also control all development of plant, materials, processes, and methods and generally prepare himself for early promotion to Technical Director.

Candidates must have at least five years' executive experience in the rubber industry, with specific knowledge of retreading processes. Some administrative and commercial responsibility would be an asset. A degree in mechanical engineering or chemistry, an A.R.I.C. or A.I.R.I. qualification would be an advantage.

Preferred age about 40. Initial salary about £2,250 with non-contributory pension scheme and life insurance. A car and new rented house will be provided. Some overseas travel will be necessary. Please send brief details in confidence quoting reference LU.9224 to J. G. Smith.

In no circumstances will a candidate's identity be disclosed to our client unless he gives permission after a confidential interview at which he will be given full details of the appointment.

MANAGEMENT SELECTION LIMITED
14 St. Vincent Place, Glasgow, C.1

(162)

APPOINTMENTS VACANT

(continued)

ENGINEER/SALESMAN, age 25/35 years, for engineering division progressive London private company. Experience plastics industry advantage. £1,200/£1,500, pension scheme.—Send fullest particulars experience and qualifications to Box 433, Reynell's, 44 Chancery Lane, W.C.2. (164)

PARKINSON COWAN require a manager for their precision rubber moulding division. Wide technical experience in formulations and manufacture essential. Must be prepared to accept commercial and technical responsibilities. Experience in thermo-plastics an advantage. Only competent and energetic men need apply.—Wellington Works, Queen Street, Great Harwood, Blackburn, Lancs. (127)

THE BATA ORGANIZATION
require a

PRODUCTION EXPERT

FOR AN OVERSEAS CYCLE TYRE AND TUBE DEPARTMENT

The successful applicant, who should be thoroughly conversant with modern methods of tyre and tube production and have experience with mixing and compounding, will be given a period of familiarisation in the United Kingdom before proceeding.

The applicant selected will be expected to assume sole responsibility for the production unit within a short time.

An excellent salary is offered with Provident Scheme and free medical care. European leave after three years' service.

Apply in writing to:—
The Personnel Advisor,
Bata Development Limited,
151 Oxford Street, London, W.1. (165)

RUBBER technologist, preferably of AIRI standard, with up-to-date knowledge of compounding and processing natural and synthetic rubbers, required for factory specialising in precision mouldings and seals. This is a senior position with appropriate salary and pension scheme.—Apply in first instance to Joseph Lucas (Electrical) Ltd., Chandos Road, Willesden Junction, London, N.W.10. (177)

LATEX TECHNOLOGIST

With the integration of Technical Service into the newly formed Research and Development Department, the International Synthetic Rubber Company Limited has a vacancy on its Technical Service Staff for a Latex Technologist.

As well as marketing a range of established Synthetic latices, a vigorous development programme is being carried out on new synthetic latices. The Latex Technologist will be concerned with the application of the existing and the new latices over the whole range of the rubber latex field and with the extension of this field to include new outlets.

Applicants should have had thorough academic and practical training in Latex Technology and should preferably be qualified in Chemistry or Rubber Technology. Applications are also invited from non-qualified Technologists who have had several years of suitable experience with latex.

The Company operates an enlightened personnel policy which includes generous holiday and sickness benefits and an excellent contributory pension scheme.

Our premises are located on the south coast adjacent to Southampton Water and the New Forest.

Housing can be made available after a short period of employment.

Applications stating age, qualifications and experience should be addressed to the Company Personnel Manager at Hythe, Southampton. (174)

APPOINTMENTS VACANT

PLASTICS EXTRUSION TECHNICIAN

P. B. COW (Plastics) LTD

invite applications for the position of Extrusion Technician to carry out production development in their Extrusion Department. A sound overall knowledge of PVC Section Extrusion, an engineering background and an ability to work under own initiative are essential requirements, although academic technical qualifications would be advantageous. An attractive salary commensurate with age, experience, etc., will be offered and applications in confidence should be addressed to:—

P. B. Cow (Plastics) Ltd.,
5 Falmouth Road,
Trading Estate,
Slough, Bucks.

and marked for the attention of the Technical Director. (116)

SMALL mechanical rubber moulding works in North Midlands requires working foreman with prospects of rapid progress. —Box 167. (167)

SENIOR process control technician wanted by George McLellan & Co., Ltd. Applicants should have qualifications of HNC standard or better; with at least three years' experience of process control in the rubber industry. Preferred age is in the range 25-35. The man appointed will find the work interesting and varied; and will have good prospects of advancement in an expanding technical organisation.—Applications giving particulars of education, experience and starting salary required to Personnel Manager, George McLellan & Co. Ltd., 125 Shuna Street, Maryhill, Glasgow, N.W. (144)

SENIOR foreman required, fully experienced in the compounding of synthetic rubbers and should have first class knowledge of all aspects of calendering. This will be a permanent progressive position in a rapidly expanding department and the selected applicant will be responsible to the existing Departmental Manager. Applicants should have held a similar supervisory position and had a number of years' experience in the above processes. Please write, giving details of age, experience, salary, etc.—Box 148. (148)

RUBBER TECHNOLOGIST/CHEMIST

required for small modern rubber factory manufacturing moulded and hand built mechanical components: to be responsible for routine testing and formulation: LIRI standard: aged 20-25 years, opportunity for further study provided.

Reply giving full details of age, education and experience together with salary required to Technical Manager, The Sutcliffe Moulded Rubber Co. Ltd., Ossett, Yorkshire. (176)

APPOINTMENTS WANTED

8d. a word, Minimum 12/- Box 2/-

EXPERIENCED manager, 40, AIRI standard, seeks post. Wide experience technical/production in dry rubber and latex processes, including foam.—Box 175. (175)

GENERAL manager, 30 years' experience, qualified, technical, production sales, seeks change appointment where initiative to expand company's activities and develop new products required. All types specialised and industrial rubber and plastics products.—Box 163. (163)

This column can be YOUR best BUYER or SELLER

RUBBER & PLASTICS

MACHINERY

Why not see for YOURSELF

MACHINERY FOR SALE

8d. a word, Minimum 12/- Box 2/-

'COTSWOLD' dipping machines and circulating tanks for latex and PVC. New catalogues now available on request. —Lionel Hook and Sons, Ebley, Stroud, Glos. Tel.: Stonehouse 614/5. (380R)

MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

For RE-BUILT
RUBBER PLASTIC
AND
HYDRAULIC MACHINERY
CONTACT
HODSON & Co. (MACHINERY) LTD
Spring Mills, Tottington
Nr. BURY, LANCS.
Phone: TOTtington 123 (099)

HYDRAULIC presses, pumps, valves, new, also large secondhand stock.—Thompson and Son (Millwall) Ltd., Cuba Street, London, E.14. East 1844. (427)

SHAW 60in. x 22in. mill with 100 h.p. drive. 30in. x 24in. and 21in. single geared cracker with 200 h.p. drive. Pair of 50in. x 18in. single geared mills with 140 h.p. drive. Several smaller mills.—Reed Brothers (Engineering) Ltd. (Mr. C. E. M. Hardie—Receiver and Manager), Replant Works, Woolwich Industrial Estate, London, S.E.18. Tel.: Woolwich 7611. (169)

NEW, 'Battleship strong' constructed, steel mangles, weight 104lbs., 4¾in. dia. x 12in. machined steel rollers with ¾in. dia. x 3in. extended drive shaft on one, bronze bearings, suitable for a variety of small rolling uses, sketch available. £6 10s. each. —Woodfield and Turner Ltd., Burnley. Tel. 78134. (178)

UNUSED 60in. x 22in. single geared mixing mill, friction ratio 1.15 to 1, Vibro mounted, Lunn safety equipment driven by 125 h.p. slip ring motor.—Box 170. (170)

Donald Leaver Limited
1 LONDON ROAD, STAINES, MIDDX. Phone STAINES 55271-2
FOR **SECONDHAND PLANT AND MACHINERY** (1057)

— PHONE RAINHAM 5655 —
PRESSES - MILLS - PLATENS - ETC.
Guaranteed Secondhand Plant
E. & V. GIBBONS LTD. LAMBS LANE, RAINHAM, ESSEX
(430)

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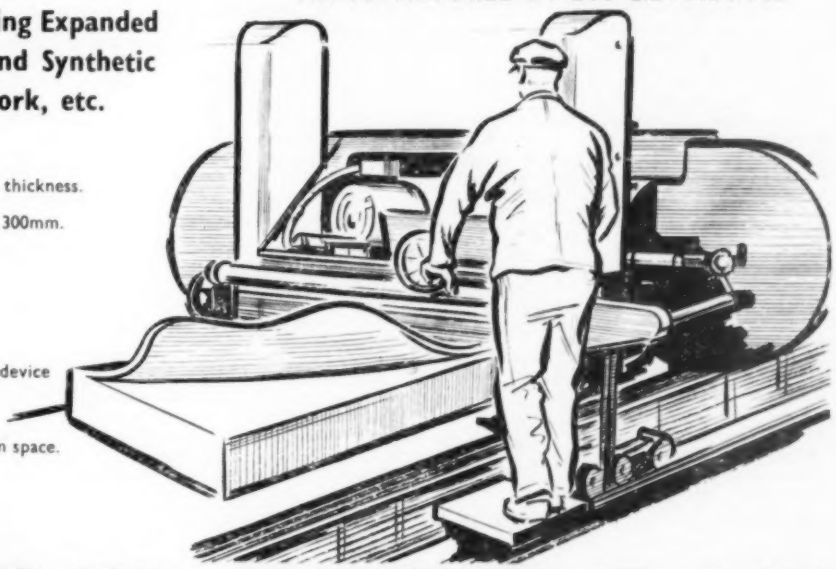

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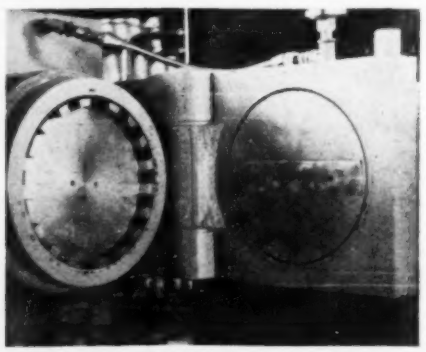

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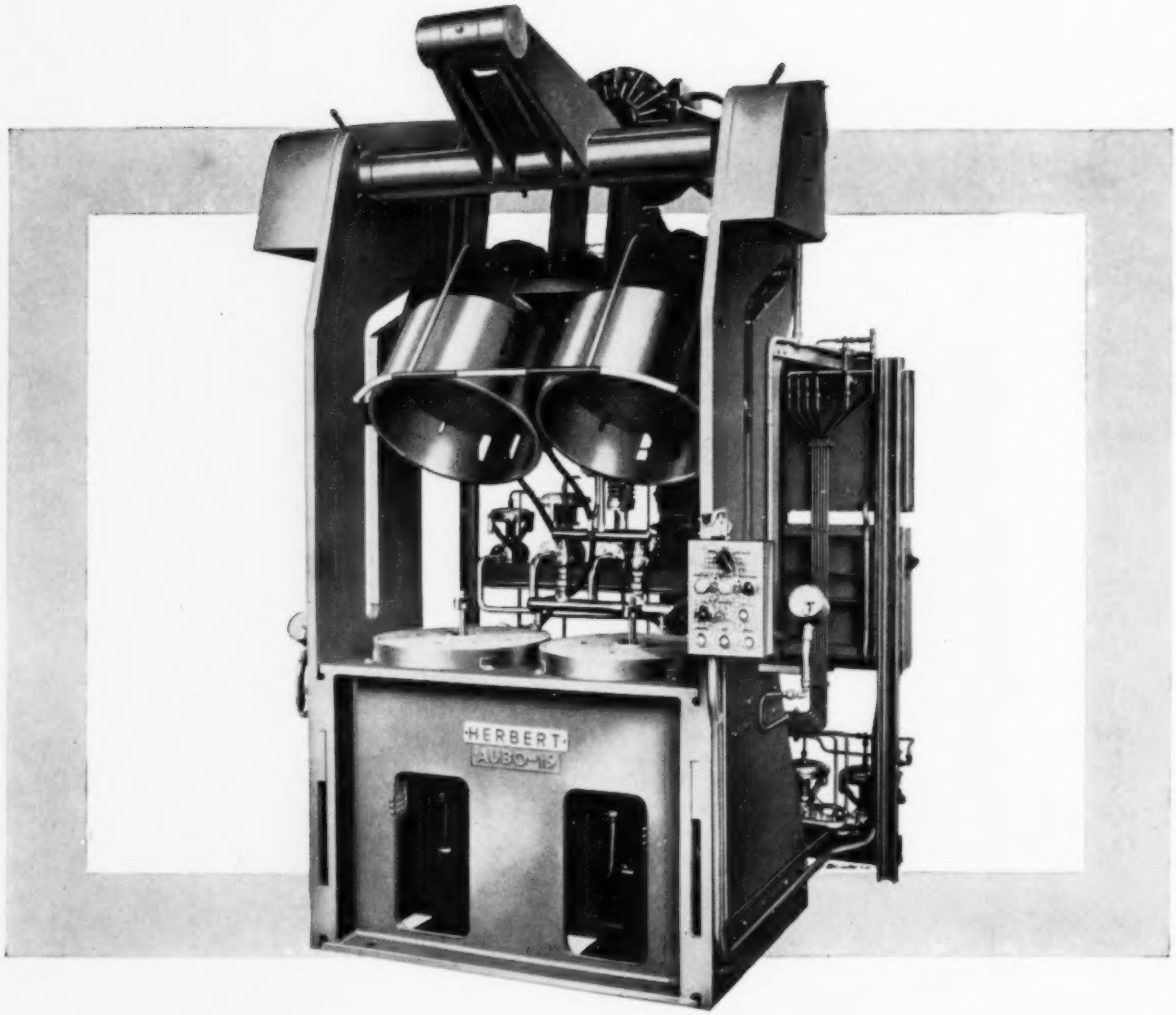

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